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NOVEMBER-DECEMBER 1965
: Management Services, Vol. 2, No. 6, November-December 1965 [whole issue]

MANAGEMENT SERVICES

a magazine of planning, systems, and controls

A Publication of the American Institute of Certified Public Accountants

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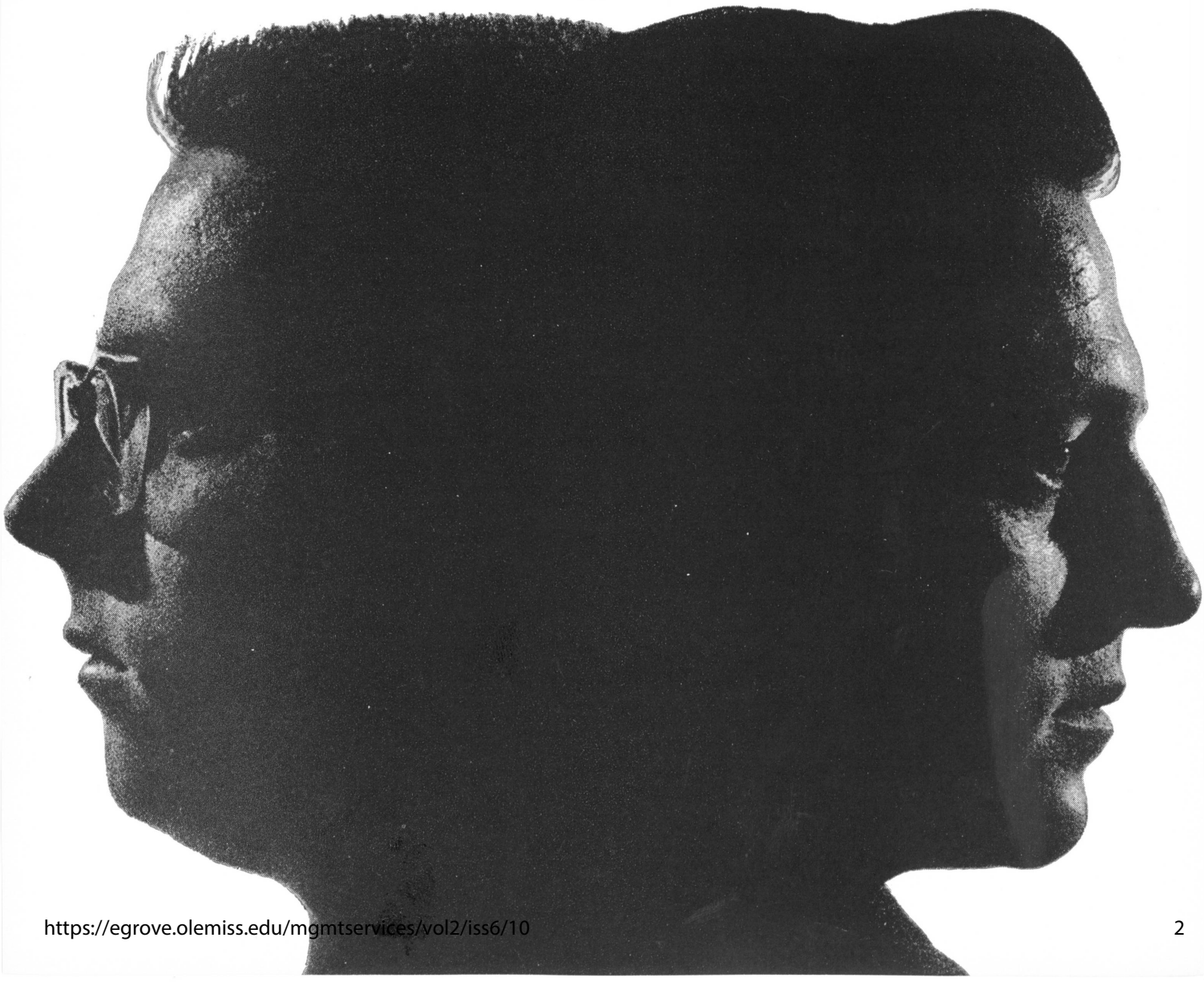
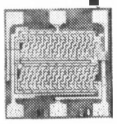


Victor's incredible little chip



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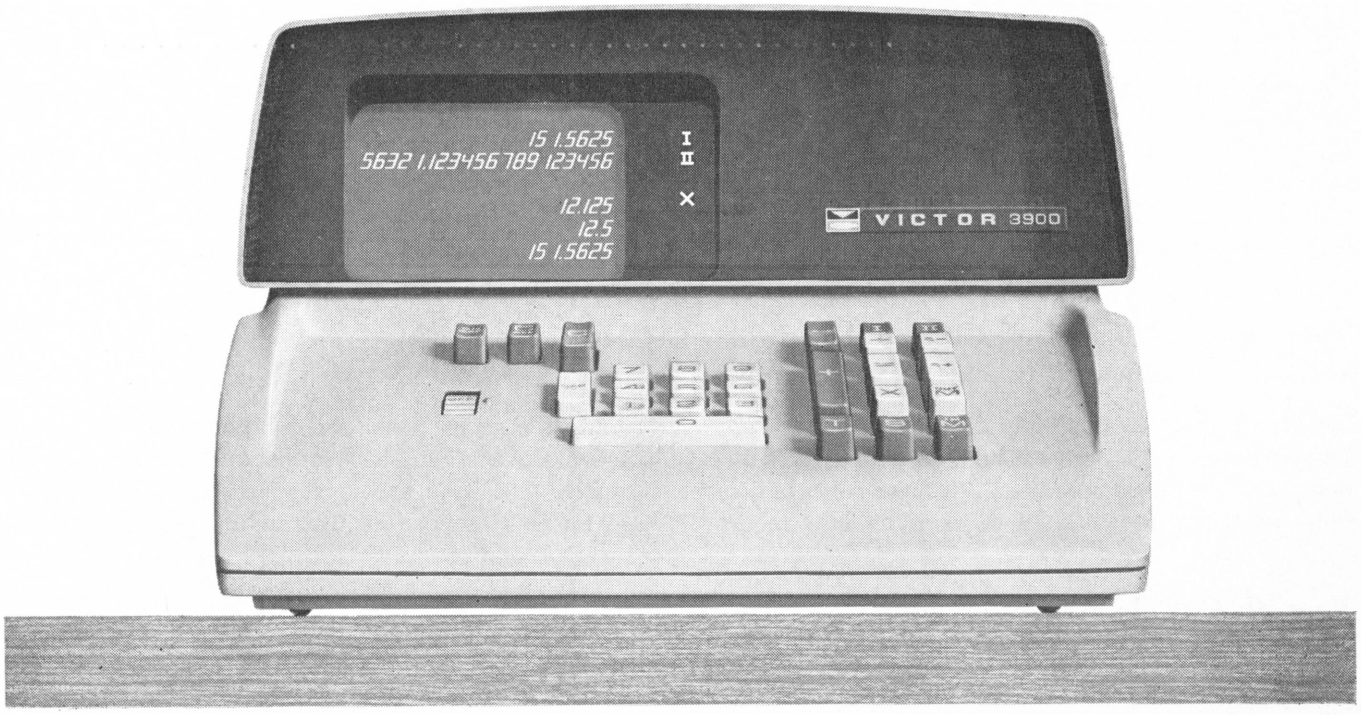
ushers in the era of the desk-top electronic calculator!



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people, events, techniques

Texas Hospital Plans Computer Installation to Free Nursing Personnel Of Much of Paperwork Burden; Other Hospitals Plan Similar Systems

Reductions in paperwork that must now be performed by nurses will, in effect, give the Santa Rosa Medical Center, San Antonio, the equivalent of 100 additional nurses once a Hospital Information System has been completely installed in 1967.

That's the prediction of Sister Mary Vincent, administrator of the 800-bed hospital complex.

The system, based on an IBM System 360/Model 30, and 38 communications terminal devices throughout the medical center, will tie the computer into every nursing station, laboratory, and major facility of the hospital including its business and admitting offices.

"Any qualified person can ask for or enter any type of data at these terminals," the administrator said. "For instance, when a doctor leaves his orders for medication and patient care, his instructions will be transmitted immediately to the computer through keyboard entry at the nursing station.

"If the orders call for tests or special food or drugs, the computer also sends the necessary information to the proper laboratory technicians, to the kitchen, to the pharmacy, and so on."

Furthermore, she added, the machine will retain the schedule in its memory, and send out reminder messages when the time for execution of the doctor's orders arrives.

Benefit: Womanpower saving

The most important advantage of the system is expected to be the freeing of professional personnel, who must now spend several hours a day on paperwork, to devote more time to their professional duties. Santa Rosa has found that its 500 nurses, for instance, spend an average of 40 per cent of their time—more than three hours a day—either gathering, recording, or referring to information. It is estimated that the electronic system will increase effective nursing time by 20 per cent.

The computer will also accumulate historical data in memory, eventually making possible statistical analyses recording incidence of illnesses by type, age, income group, geographic locations. Such analyses can be developed in minutes once a large enough amount of basic information on individual records has been stored in the machine.

Other hospitals and hospital groups across the country are either investigating, preparing, or have already installed systems roughly analogous to that planned for the Santa Rosa Center. These include:

The Veterans Administration, which plans a total Automated Hospital Information System

The Massachusetts General Hospital, Boston

The New York State Hospital Association, which expects to start such a system with about ten hospitals in the Albany, New York, area

The Chicago Hospital Council

The Children's Hospital, Akron, Ohio

The Fairfax, Virginia, Hospital Group

The Sisters of the Third Order of St. Francis, who are planning a centralized computer system for accounting applications in their 12 institutions

Montefiore Hospital, New York, which has already put accounting applications on a computer and is now experimenting with direct recording of laboratory work

Puerto Rico Hospitals, where 11 hospitals will be tied into one computer

Barnes Hospital, St. Louis, which already has accounting applications on a computer and is now expanding its operations to cover laboratory records.

Computer Sales Rising, Are Expected to Pass $2 Billion in 1966

The office equipment and furnishings industry has now passed a six-billion-dollar-a-year volume, Walter W. Finke, president, Electronic Data Processing Division, Honeywell, Inc., reported at the opening of this year's Business Equipment Exposition last month in New York.

Of this volume, over three billion dollars is accounted for by electronic data processing equipment and peripheral machines, Finke, who is chairman of the Business Equipment Manufacturers Association, the exposition's sponsor, reported.

He said that computer shipments and sales from U.S. manufacturers for 1965 would be about $1,750,000,000, which represents a quarter-billion-dollar rise over 1964 figures. More than two billion dollars in sales is anticipated for 1966.

The difference between the figures he cited and the three-billion-dollar estimate for the industry as a whole is accounted for by the "peripheral equipment" needed in data processing systems.

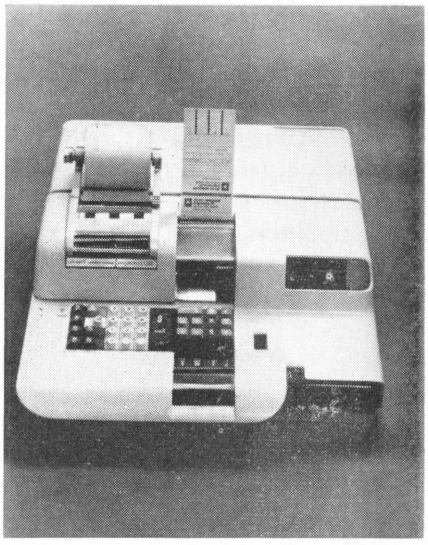
On a unit basis, Mr. Finke reported, the end of the year will see approximately 27,000 computers installed and operating. Of these, 20,000 will be full-sized data processing systems; about 7,000 will be of the desk-size variety. He defined the essential difference between the two by saying that the full-scale systems have full capacity to be internally programed and peripherally expanded, while the desk-size systems do not. However, he conceded that the line of demarcation between the two types of machines is very hazy.

Next year, more than 8,000 additional units of both categories will be shipped, he predicted, for an installation rate of nearly three dozen per day throughout the entire year.

At the business equipment show itself, nearly 100 new products and services were exhibited for the first time. Among the most interesting were the Olivetti Underwood Programma 101, a $3200 desk-top computer, which fits Mr. Finke's definition since it is externally programed. However, the programs for the unit are stored on magnetic cards which can be created originally on the machine itself by keypunching, and which thereafter simply have to be inserted in the machine for repetitive instructions.

The Programma 101 can also make logical decisions according to the program. Results are printed out on paper tape. Since it is a completely self-contained unit, which can print its own programs, when they are first written, directly on blank magnetic cards inserted in the machine, no peripheral equipment is required. One hundred and twenty instructions may be written on a magnetic program card.

IBM, which introduced several new products, showed a 2250 Display Unit that can be used with its System/360. The 2250, a television-like tube, shows graphically information extracted from the computer. The company demonstrated it by showing the simulated maneuvers of a Gemini spacecraft (unfortunately, the demonstration was first held on October 25, the same day the real Gemini flight was aborted), in which the various positions in the orbital flight were translated into the mathematical curve which the craft should have taken. Also shown were graphic representations of the structural design of a bridge translated from the



IBM Display Unit 2250 (above) graphically shows planned course of Gemini space flight plotted by System/360. Olivetti Underwood Programma 101 small computer (right) is programed by magnetic card insertion.

engineering calculations for the bridge design and an information retrieval technique for locating alphabetic and numeric information.

Drug Company Uses Market Model to Predict Success of New Products

Warner-Chilcott Laboratories, by using a model of the drug market, hopes to be able to predict future success or failure of a new product on the basis of its performance in the first three months after its release.

The plan was outlined by E. Rex Smyth, director of marketing research and planning for Warner-Chilcott, in a speech before the American Marketing Association in New Orleans last month.

He called the new program an "early warning system," planned to provide management with advance information on how well its new products are faring against those of competitors. This allows management to take quick appropriate action in terms of promotion, production, purchasing, and capital outlays.

Tested on accepted drugs

In the feasibility study that preceded installation of the new system, the computerized model was tested successfully on thirty previously marketed drugs on the basis of their sales figures for the first three months after their introduction.

Smyth pointed out that under the new program, if sales for the first three months indicate that a new product is getting a good response, additional support can be given it with even better results. By the same token, if early evidence shows that the product is not selling well, the company can drop it before too much money has been lost.

The same holds true for competitive products, he said. The computer program could show whether a rival's product was worth giving serious battle, or could safely be ignored.

The Warner-Chilcott predictive model, developed over a period of two years, will be extended to forecast year-end sales for the entire product line, Smyth reported. Studies are also under way to see how computers can be utilized to help select media for advertising campaigns as well as to find the most profitable resource allocation for the marketing mix.

IBM Changes Discount Policy for Customers Renting Machines

IBM last month reversed its policy of giving large discounts to customers who first rent equipment from the company and subsequently decide to buy it.

The new policy doesn't affect equipment rented before October 1 of this year. All rentals after that date, though, are subject to the new rules.

The old markdown system worked in this way: A customer who did not want to make the heavy initial investment of buying a computer could rent one from IBM. But if he later changed his mind and decided to buy, IBM would give him a 5 per cent purchase discount on the equipment he was already renting one year after installation and 10 per cent after two years up to a maximum of 55 per cent for equipment 5½ years old.

Ostensible reason for the switch in policy: Improved maintenance and reconditioning make it possible to "provide equivalent performance levels in machines with different dates of manufacture." In other words, age of a machine is no longer a measure of its economic value.

Skeptical observers, however, noted that the change in policy would make it much less attractive to customers to hold on to present equipment, and, consequently, much more attractive to install new equipment. And IBM began making deliveries of its brand new System/360 computers this past April.

The manufacturer also announced a new purchase option plan under which the old deposit of 1 per cent of the purchase price required of the customer in taking an option to buy has been dropped. Under the new plan all customers who rent equipment will get a credit that can be applied against the purchase of the machine. The credit amounts to about 12 per cent of the cost of the machine. Significantly, however, the credit is based on the prime shift rental of the machine for the first twelve months. Thus, after he has rented a machine for one year, the customer has gained his maximum credit. Further rental will give him no added purchase benefits.

360 deliveries delayed

IBM has advised its customers that most 1966 deliveries of System/360s will be 60 to 120 days behind schedule.

The company cited as reason for the delay: "problems in building up the rate of production of the System/360 as rapidly as necessary to meet the unprecedented customer demands for the new equipment."

In order to meet these production requirements IBM is building new plants in Boulder, Colorado; Raleigh, N.C.; Montpellier, France; and Vimercati, Italy. It is also expanding present facilities at Owego, Fishkill and Endicott, N. Y.; Burlington, Vermont; and San Jose, California.

The annual Index of MANAGEMENT SERVICES, *covering all articles published in 1965, including those in this issue, appears on page 62.*

Mrs. Marie Kiefer, NARGUS executive director, and Frank L. Brown, merchandising director, inspect detailed data summarized and classified for retailers' guidance.

Grocers' Group Publishes Operating and Financial Standards as Yardsticks

Comprehensive operating and financial standards to be used as guideposts by supermarkets were published last month by the National Association of Retail Grocers of the United States.

Designed to provide food retailers with key operating figures and financial data for comparing and analyzing store operations, the 154-page volume is based on detailed data assembled from more than 400 varied-volume food stores. The data were summarized and classified in a computer program developed by NARGUS and Purdue University.

"Food retailers can now quickly compare operating costs, profit, inventory turnover, sales per man-hour, departmental operating ratios, parking areas, and scores of other key areas with stores of like size and type," Mrs. Marie Kiefer, NARGUS executive director, explained. "Key operating data are provided in the most modern, usable form ever developed for the food industry."

Information in the book is grouped by several characteristics:

population, type of customers served, labor factors, major supply sources, size and type of business organization, store area, store hours, promotional activities, and sales volume and geographical location.

Wholesale groups using centralized accounting services cooperated with NARGUS on the study as did individual accountants retained by participating stores.

"NARGUS Financial and Operating Standards for Supermarkets" sells for $20, and may be ordered from NARGUS, 360 North Michigan Avenue, Chicago.

A short time before the NARGUS announcement, the nation's third largest food chain, Kroger Company, offered to sell to grocery manufacturers weekly figures on shipments of branded goods from warehouses to its 20-state-area 1,300 retail outlets.

Purchasers of the service will be able to gain exact breakdowns on sales of their products in Kroger stores as compared with their competitors' sales, the prices paid for all brands, and their share of the total Kroger market.

Charge for the service is $150 a week for each product group, $100 if five groups are bought, and $50 for each additional category over five products.

The weekly reports are based on figures furnished by Kroger's automated inventory system. As other large retail chains switch to keeping inventory records on computers, it is probable that they will offer similar services, industry spokesmen predict.

ADAPSO Offers Directory Of Processing Centers

A directory of data processing centers in each of the fifty states, Canada, Latin America, and Europe has just been published by ADAPSO, The Association of Data Processing Service Organizations, Inc.

The directory contains the name and address of each service center which is a member of ADAPSO. Qualifications for membership: "'for profit' organizations which utilize their own equipment, on their own premises, assume full responsibility for the finished product, and which have completed one full year of successful operation."

Copies of the 1965-66 directory may be ordered from ADAPSO, 947 Old York Road, Abington, Pa. 19001, for one dollar each.

United Air Lines Expands Ticket Accounting System To Accept Cross-Payments

United Air Lines plans to expand its automatic ticket accounting system by exercising an option to purchase the Electronic Retina Computing Reader it has been leasing from Recognition Equipment Incorporated and has ordered additional equipment to be leased in the future.

The present system, in use since October, 1964, eliminates almost all manual keypunching of data from United's automated ticket accounting operation.

Airline tickets, even if torn or crumpled, are fed into the Retina Computing Reader as they are received from United ticket offices from all over the country. Like other types of credit cards, the tickets are precoded with plastic matrices which indicate ticket number, route, total fare, actual airline carrying the passenger, and account number if it is a charge sale. The system reads this information from the ticket, edits and stores it on magnetic tape, and automatically sorts tickets.

More than 2.5 million documents, including airline tickets, airbills, and refund checks, are processed each month, yet the system has a total rejection rate of less than 2 per cent.

Units included in the existing system are:

Electronic Retina and Recognition Unit, which, using a technique based on a study of the retina in the human eye, reads and identifies numerals and symbols in two different type fonts

A Document Carrier, which transmits 600 documents per minute through the system and can handle intermixed papers from nine-pound to card stock, and

A Programed Controller, which directs the entire system and records data.

The additional new leased equipment will enable United's accounting operation to include nonstandard tickets from travel agencies and cross-payment forms between airlines, plus a variety of page-size statistical accounting forms.

Recognition Equipment Incorporated also has agreed to develop an electronically controlled securities quotation display for Trans-Lux Corporation.

The quotation display is a much smaller version of the 45-foot quotation board installed by Recognition Equipment at the New York Stock Exchange last July.

On the new display device, stock symbols and prices will be shown as bright green, two-inch-high characters, moving from left to right across the display.

Letters and figures will be formed by thousands of tiny discs mounted on a moving belt. Jets of air will flip the discs to form various characters just before they move into view on the display.

Each disc will be painted a bright luminous yellow-green on one side and black on the other. Ultraviolet lights will make the discs glow clearly and brightly against a black background, so that a man standing more than 75 feet away will be able to read the characters easily, even in a well lighted room.

From 40 to 80 characters can be seen at once, depending on the length of the display, and the display will operate at speeds up to 900 characters a minute, depending on the amount of trading activity.

Portion of Recognition Equipment's stock quotation display at the New York Stock Exchange. Smaller unit has been developed for brokerage firms.

Trans-Lux, which has the option of buying the displays from Recognition Equipment or manufacturing them itself, will market the new device under the trade name "Trans-Jet."

First delivery of the new display is planned for 1966.

Six Federal Employees Honored for Contributions To Simplification of Government Paperwork By Administrative Management Society

Six Federal management employees were recently honored at an Administrative Management Society banquet for their contributions to the simplification of Federal Government paperwork requirements.

Awards were based on the greatest effectiveness in achieving economies "in terms of cost savings opportunities."

Congressman Arnold Olsen, Montana, toastmaster for the banquet, stated that since the Administration's "War on Waste" began, savings in Federal paperwork have amounted to over $100,000,000.

From the 22 nominees for AMS Paperwork Management Awards, those selected for top honors were: Sam C. Beckley, Veterans Administration; Edwin G. Callahan, Housing and Home Finance Agency; Marden D. Kimball, Department of Agriculture; Thomas J. Pugliese, Atomic Energy Commission; Edward Rosse, Department of Health, Education and Welfare; and Donald J. Somon, Department of State.

The Administrative Management Society is a professional society of administrative managers whose purposes are "to promote improved management and administration in business, government, and other organizations through various educational processes."

Dr. Harry C. Jordan, Dr. Gerald L. Davey, and John T. Gauss, Credit Data Corporation's president, vice president, research, and vice president, western region, respectively, check hard copy credit information produced by computer. Operators in background respond to phone queries with credit information extracted from computer.

Los Angeles Company Starts Regional Information Center for Pooling Credit Records of Area Residents

Credit Data Corporation in Los Angeles has inaugurated what it calls the "world's first fully automated regional information center to pool credit experience."

"Instant" credit information contributed by subscribing banks, oil companies, department stores, and other credit-granting agencies is stored in computer files where it can be made available almost immediately on inquiry from another subscriber.

Credit Data Corporation says that it can furnish data on any individual in its file within 90 seconds.

More than 225 firms in the four counties of Los Angeles, Orange, Riverside, and San Bernardino had subscribed to the service by its opening date, September 22.

Each business entering the system agrees to furnish credit information on each of its customers. Thus individual credit records in the computer are constantly updated. When anyone applies for credit at any subscribing company, a telephone call to CDC headquarters giving his name, address, and identifying information produces all information noted on his credit record.

No evaluations

Credit Data Corporation emphasizes that it in no way evaluates a person's credit standing, but merely reports on the credit experience other subscribing companies have had with him.

Other centers, similar to the one in Los Angeles, will soon be opened, according to CDC spokesmen, and by next spring it is hoped that the system will cover the entire state. Eventual goal: electronically linked central credit files serving all population centers in the nation.

Cost of inquiries at the Los Angeles center is estimated at 63¢ per query on applicants for whom information is filed; 33¢ for those on whom no credit record is available.

Ream Appointed to Head Federal Computer Center

Norman I. Ream, former director of systems planning for Lockheed Aircraft Corporation, has recently been appointed by the Federal Government to head its new Computer Science and Technology Center.

The new Computer Center is part of the National Bureau of Standards. Its purpose is to aid government agencies in the selection, acquisition, and use of EDP equipment.

One of the Center's immediate projects in the area of standardization will be to guide an executive branch development program to measure and test voluntary computer standards.

Other functions of the Computer Center will be: to recommend techniques and language standards for equipment and services acquired by the government; to provide consulting and advisory services to Federal agencies interested in developing or installing new EDP systems; and to conduct research on information systems design and on computer sciences.

'Myths' Hampering Work Measurement Attacked

The four myths that have been impeding improved productivity and lower costs in office work are fast disappearing, according to Harold W. Nance, president of Serge A. Birn Co., Inc., a management consultant firm located in Louisville and New York.

Speaking before an American Management Association seminar, Nance outlined the four myths surrounding clerical tasks as:

"That the job requires a lot of creative ability and would be impossible to measure;

"The amount of judgment needed for this job precludes measurement;

"Measurement would hurt mo-

rale and might even bring union-ization; and

"We need all our people for peak loads."

In rebutting these beliefs, Nance stated that the creative and judgment aspects of clerical work were vastly overrated, that work measurement in an office often serves to boost morale since employees know what is expected of them, and that "peak load" problems can be solved effectively by interdepartmental cooperation and sharing of available personnel.

On Line Time-Sharing Services for Municipal Bond Dealers Offered

Munitype, Inc., a New York City computer center, is now offering an on line, time-sharing computer system to municipal bond underwriters and dealers in the New York area.

Teletype machines in subscribers' offices will be directly connected by telephone wires to a central General Electric computer (located at Munitype). The system can handle up to 100 lines simultaneously and will provide answers to complex statistical and bidding problems within seconds.

The system includes a GE-215 computer, a disk storage unit capable of filing 5 million characters of information, and a Datanet-30 communications processor for transmitting information in and out of the computer.

The system works like this:

First of all, pertinent information on new bond issues is fed into the computer.

Subscribers will then relay over teletype lines information on coupon and reoffering yields for each maturity, desired profit, and the date for gross production.

The computer will then proceed to calculate the dollar price of each maturity, gross and unit production, bid figure earning desired profit, gross interest, net interest less discount, and net interest cost expressed as a percentage.

All this will take only seconds.

The primary advantages of the new system, according to Munitype, are the rapid preparation and computation of statistics on new bond issues, and the availability of such a comprehensive computer system to smaller bond houses.

Although the new time-sharing system is being offered initially as a bond service, Munitype expects the general purpose system eventually to extend to other areas and broader applications.

Basic cost to subscribers is $300 for the private line guaranteeing unlimited access to the central computer, and $125 for line charges for telephone service.

Magazine Controls Set For Split Run, Regional Editions by Computer

Problems of production and distribution of the "split run," regional edition magazine are being solved by Meredith Publishing Company, Des Moines, Iowa, with an IBM 360 computer.

Split run? Regional edition? They're magazine terms, and they represent a growing headache for most national magazines.

Better Homes and Gardens, for instance, is Meredith's largest publication, with a national circulation of 6,750,000. But any one issue can have as many as 70 regional editions, which vary each from the other in advertisements and some editorial matter. In addition, each of these localized publications is divided again, with different variations for newsstand sale and home delivery. So in all one issue can represent 140 different products.

The problem is twofold: getting the magazine designed for the Southern California area to Los Angeles and the one designed for New England to Boston and doing it all on a tight timetable to meet mailing requirements.

Experiments showed that preparing an optimum labor and equipment schedule for one issue would take six to eight man-weeks with manual methods. But *Better Homes and Gardens* is a monthly publication, and that much of a time lead was obviously impossible.

The computer, on the other hand, when fully operational, is expected to find the optimum schedule for labor and equipment within minutes.

Executive Search Firm Publishes 'Profile' of Chief Financial Officer

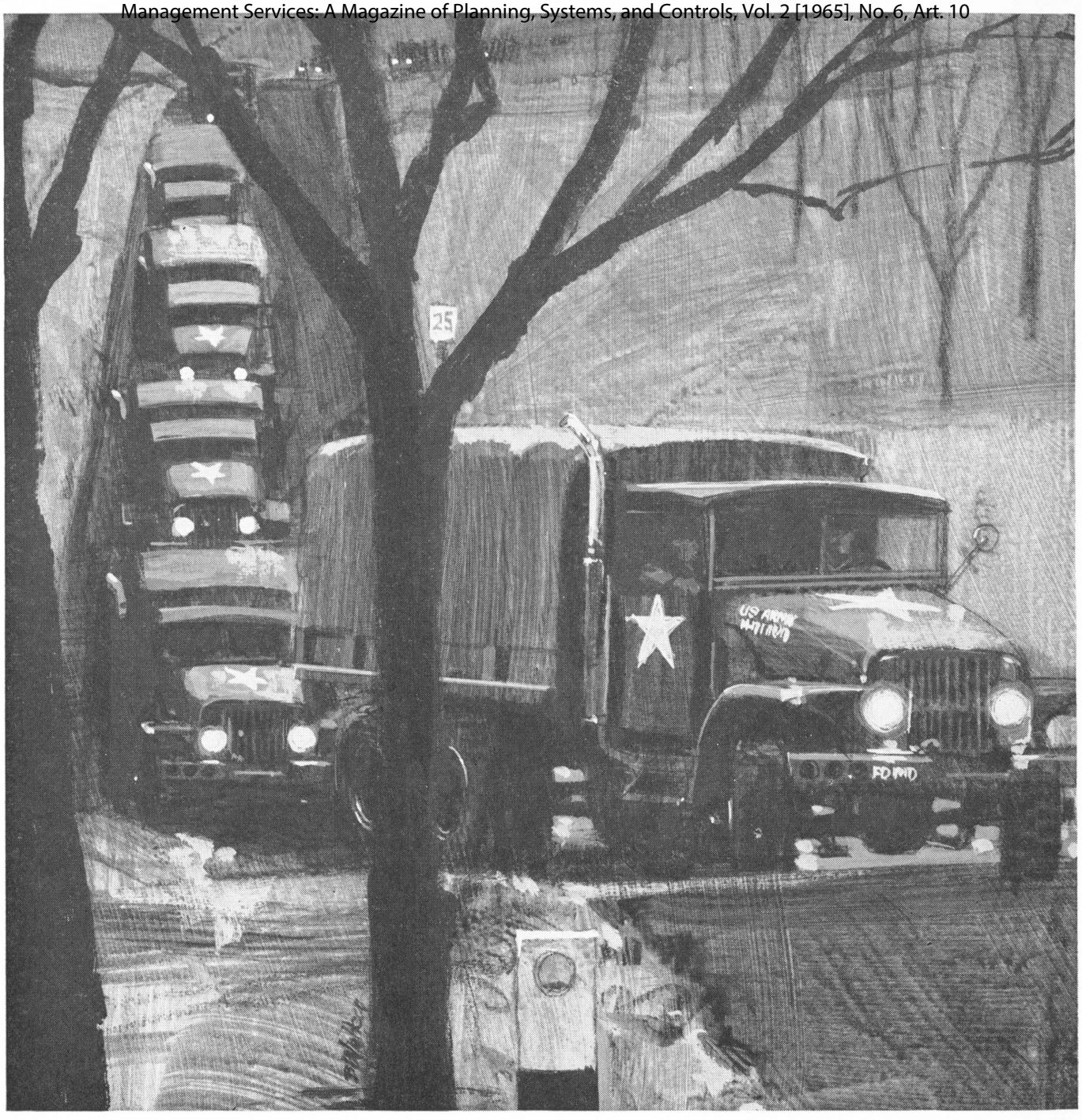
His median age is 53, and he has held his present job for less than five years. He's a college graduate and, in many cases, holds a postgraduate degree. Usually he started his career in an accounting or clerical job.

That picture of the chief financial officer of the nation's largest companies emerges from a study recently issued by Hedrick and Struggles, one of the country's oldest executive search firms. The study was based on a survey taken of financial men in America's 500 largest industrial concerns, 50 largest utilities, 50 major merchandising organizations, 50 leading life insurance companies, and 50 major transportation companies.

The composite financial executive's college is most likely to have been California, Illinois, the University of Pennsylvania, or Yale. His postgraduate degree — and a very high percentage hold such degrees — is most apt to have been taken at Harvard.

His salary usually is high. Three out of five of the executives surveyed make over $50,000 annually; one in five of those in the very largest companies makes more than $100,000.

He has worked for two or more companies, but he has definitely not been a job-hopper. Less than one per cent of those surveyed had worked for six or more companies.



Who beat Goldfinger to Fort Knox?

Strangely enough, we did!

American industry, dynamically expanding abroad. American military might, defending democracy around the world. America helping our world neighbors and future trading partners to get on their feet economically.

These are just some of the ways we spend money overseas, all for good purposes. Yet, when we spend more abroad than we receive from abroad, we have a balance-of-payments deficit. Foreign countries can demand gold for their dollars. And they get it. Immediately. Without question.

For the American dollar is as good as gold.

To keep it that way, President Johnson, our government, our businessmen and bankers are already working to eliminate our balance-of-payments deficit by reducing our loans and expenditures abroad. Behind their efforts is the most productive and efficient economy in the world.

"Let no one doubt it," said the President, "we will eliminate our international deficit...This is a problem that involves all of us. I know the American public will respond in full measure to the challenge."

What can you do? Get a free booklet, "Keeping the American Dollar Strong." Write: "Good as Gold," Dept. of Commerce, Washington, D.C. 20230

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The new stress on integrated information systems has outdated the traditional organization structure of the accounting department. The authors suggest creation of a new information systems group.

ORGANIZATION FOR EFFECTIVE INFORMATION FLOW

by W. Thomas Porter, Jr., and Dennis E. Mulvihill
Touche, Ross, Bailey & Smart

A GREAT DEAL has been written about "total business systems" and the "systems concept." Much of it may be more fiction than fact. Nevertheless, there is plenty of empirical evidence that systems are being designed to integrate previously disorganized resources of men, machines, and money into total systems for effective accomplishment of objectives.

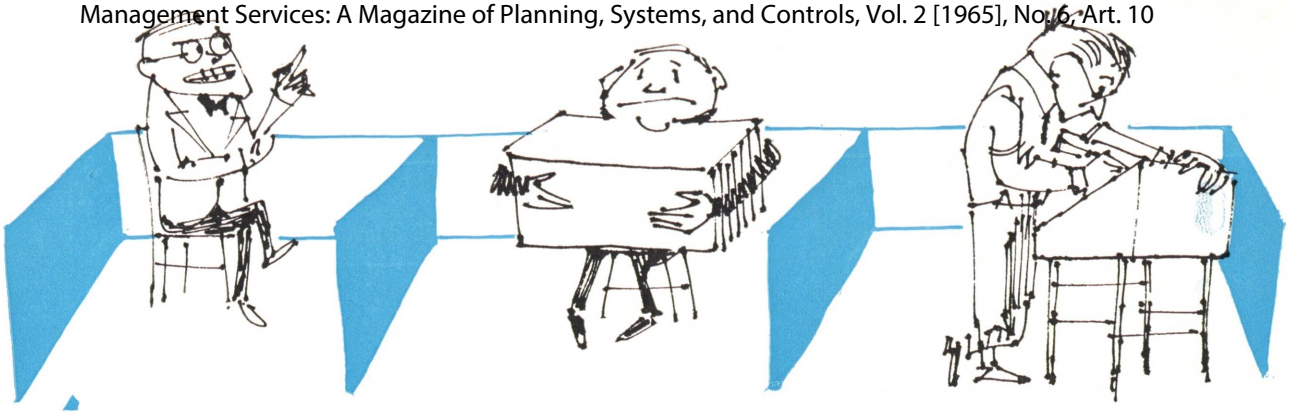
The underlying prerequisite for a total information system is an organization structure designed around projects and decision systems rather than around separate functional areas such as marketing, production, and finance. Traditional organization theory, emphasizing the separation of activities into functional areas, does not give sufficient recognition to the interrelationships and interdependencies of the various activities.

Ultimately the trend to total information systems will bring far-reaching changes in organization structure throughout the companies affected. The immediate impact, however, has been on the accounting organization, and it is on that area that this article is focused. The article examines the organization of the accounting function historically, emphasizes the need to challenge traditional organization concepts, and suggests some guideposts.

Traditional organization

Typically, the traditional manual accounting system has been organizationally divided into major sections related to financial accounting outputs: the cash section, the billing and accounts receivable section, the accounts payable section, the inventory control section, and the capital assets section. With the introduction of punched card equipment, the accounting organization remained much the same except for the addition of an accounting machines section.

Each of these accounting units performed a part of the traditional accounting function of recording, classifying, summarizing, and reporting business transactions within a financial accounting framework. The separation of accounting tasks was important for two reasons. One was that such a separation was a key to efficiency and productivity. In a manual system people are the



The basic principle of internal control is the separation of duties among the people who authorize a transaction, the people who have custody of the asset acquired, and the people who record the accountability for the asset.

major processing vehicle, and specialization is necessary to handle effectively the volumes of transactions encountered in any but the smallest business organization. Another important reason for the separation of duties was to provide adequate internal control to safeguard the company's assets and check the accuracy and reliability of accounting data. The basic principle of internal control is the separation of duties among people who authorize a transaction, people who have custody of the asset acquired, and people who record the accountability for the asset. This basic separation must be maintained in any data processing system to assure adequate internal control.

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Electronic systems

As business data processing evolved from manual through punched card equipment to electronic data processing (EDP) systems, there was seldom a corresponding evolution of management thinking. Commonly computers were regarded merely as large accounting machines which represented only a further mechanization of the data processing function by the accounting machine section. This attitude was reinforced by the way in which the computers were used. The great majority of early computer installations included such traditional accounting applications as payroll and accounts receivable. These early installations were originally justified not on the basis of giving management greater information and control of the entire business operation but on the basis of the computer's ability to perform certain kinds of work faster and more economically. Because of the stress on accounting applications, the electronic system was swallowed by the accounting department within its existing organizational framework.

With increasing competence and confidence in the use of computers and growing recognition of the computer's full potential for improving overall operations, more companies are moving into newer and more sophisticated applications affecting basic business operations. These advanced electronic systems are characterized by the integration of data processing activities. Today one enterprise after another is planning to integrate disparate uses of computers and to eliminate duplicate demands. Related elements in different data processing activities are being combined into common coordinated procedures and work flows. The aims of this combining are the preparation of all desired managerial reports from a single recording of each business transaction and the integration of financial and accounting data with operating data. Such integrated systems have been made possible by recent developments in data collection equipment, communication facilities, random access storage devices, advanced software techniques, and time-sharing hardware.

Figure 1 on page 17 illustrates an integrated system. The introduction of a customer order creates an open order file, which is used to prepare invoices and update accounts receivable files. The origination of the customer order also affects raw material orders, crew scheduling, production scheduling, finished inventory, shipping orders, sales commissions, and market forecasts. The order, through its effect

on inventory levels, automatic reorder and the issuance of a purchase order with subsequent creation of a liability requiring payment to a vendor. Under such a system the purchase order is created by the customer order because the latter's effect on reorder levels and quantities is determined by mathematical formulas designed into the system. In such a system the operational aspects of order entry, billing, accounts receivable, inventory control, purchasing, and accounts payable are interwoven.

The design and operation of an integrated system require a more comprehensive systems point of view than that based on the traditional accounting functions of cash, billing, accounts receivable, inventory, and accounts payable. The traditional functional breakdown in the accounting organization is not adequate to meet the demands of the integrated systems approach. New organization concepts are needed.

EDP characteristics

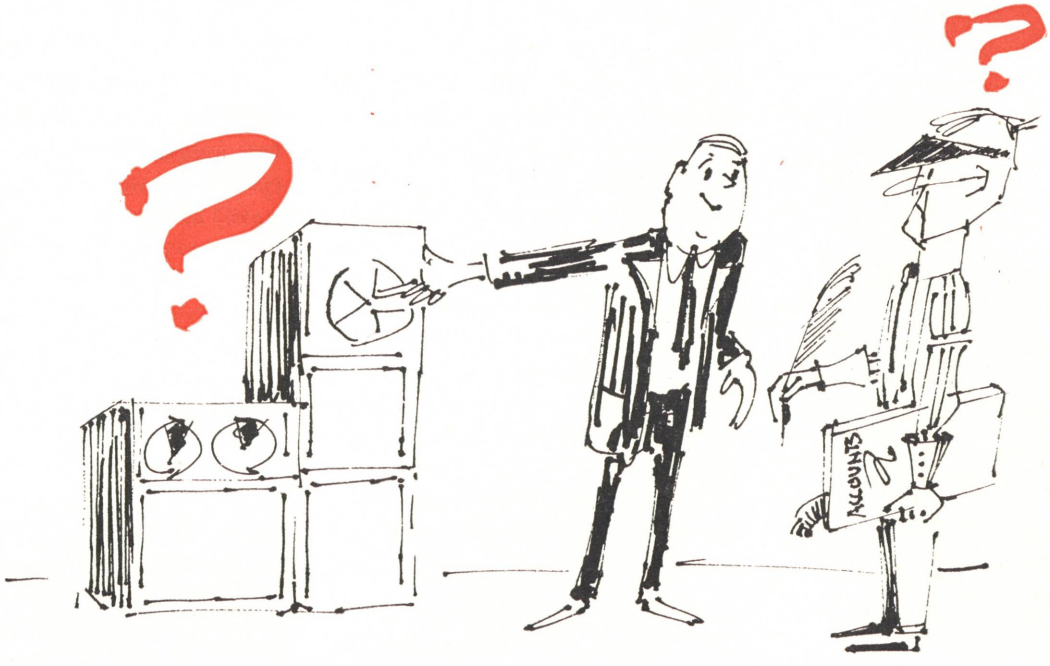
Several characteristics of EDP operations and of systems output form of organization that is appropriate for an integrated EDP system.

The first characteristic is that of system control as contrasted with individual control. In manual processing of accounting information, each individual involved in the processing flow exercises a certain amount of control as documents pass through the various stages of the accounting process. Some people exercise control by reviewing source documents for invalid transaction codes, unreasonable amounts, arithmetic errors, and other improper data. Others compare totals of individual items to independently derived control totals.

In manual systems, then, the internal control is largely achieved by individual review and cross-check. In an EDP system, however, control is systems-oriented rather than people-oriented. The reason is that the transactions are either entered into the processing flow in machine-readable form or are converted to machine-readable form early in the processing system. The transactions are then processed without human intervention or under the control of programs. These programs, internally stored in computer memory, constitute the systems, and much of the control is embodied in them in the form of programed checks.

Such a transfer of activities previously performed by many people to one "person" is not a surrender of internal control. In fact, the kind of control attributed to separation and specialization of clerical functions is strengthened in electronic systems because of (1) the computer's uniformity in the execution of policies and procedures and (2) the difficulty of making changes in the detailed and complex program instructions.

A second characteristic of electronic data processing systems is the opportunity they offer to develop information for planning and control. In many traditional accounting departments data processing has resulted in information that is oriented not to the planning and control functions of management but to its stewardship function. In our society, where the separation of ownership and management is widespread and where information



At first, management regarded computers merely as large accounting machines.

An information system must be designed to provide information throughout

Information for planning and control should be assembled and reported in relation to the inputs of production and in relation to the objectives to be attained.

on management's use of private capital is important to the free flow of funds in our capital markets, the external report of financial condition and results of operations is an important output of any information system. But to control the company's operations management requires information that is not summarized and classified in accordance with external reporting classifications. As one author points out, "By its very nature traditional accounting fails to highlight many important aspects of business operations. Accounting systems often are designed primarily to meet SEC, Internal Revenue, and other statutory requirements — requirements, that, more often than not, fail to correspond to management's information needs. Accounting describes the past in dollars, usually without discriminating between the critical and noncritical elements of a business—the elements that control competitive success in a particular industry and the elements that do not."[1]

Information for planning and control must be assembled and reported in relation to the inputs of production — land, labor, capital — and the objectives to be attained — job, process, product, service, project, program. The traditional functional accounting organization is not suited to management's information needs for planning and control. An information organization must be designed that will keep management up to date on customer inquiries, inventory management, program costs, and other information needed for performance evaluation and decision making as well as for custodial accounting.

The accounting system should be viewed as part of an information system. An information system may be defined simply as the source of the information that management uses for its various purposes—planning, control, decision making, and external reporting. Thus, in discussing a new organization, we are discussing an information organization structure rather than an accounting organization structure. The need for such a structure has been succinctly stated by one author, "Somewhere, somehow, management must carve out a place in its organization chart for a major responsibility which has to do with the entire process of quantitative information gathering, inclusive of the accounting function but definitely not limited to it."[2]

Since a system by definition requires an interrelationship among the parts to constitute a composite whole, an information system must be designed to provide information throughout various subsystems and to include some feedback mechanism. Johnson, Kast, and Rosenzweig have outlined a simplified version of such an information system; it is reproduced in Figure 2 on page 18.[3]

Information organization

The aforementioned purposes and elements of an information system suggest some such information system organization as that illustrated in Figure 3 on page 19. The three major organizational groupings would be systems design and development, data processing, and control. The manager of each of these groups would report to a top executive who might be designated director of information systems. He,

[1] D. R. Daniel, "Management Information Crisis," *Harvard Business Review*, September-October, 1961, p. 113.

[2] R. Beyer, "Management Services—Time for Decision," *The Journal of Accountancy*, March, 1965, p. 48.

[3] R. A. Johnson, F. E. Kast, and J. E. Rosenzweig, *The Theory and Management of Systems*, McGraw-Hill Book Company, Inc., New York, 1963, p. 85.

various subsystems and to include some feedback mechanism. . . .

in turn, should report to the chief executive officer. The responsibility of the director of information systems would be to furnish information to management for the operation of the business. However, as one author points out,[4] more than just a reporting function would be involved: "In effect, the decisions management makes and the policies they put into effect would flow to the corporate structure through this department from the information services point of view. Vice presidents and department heads would still manage and supervise."

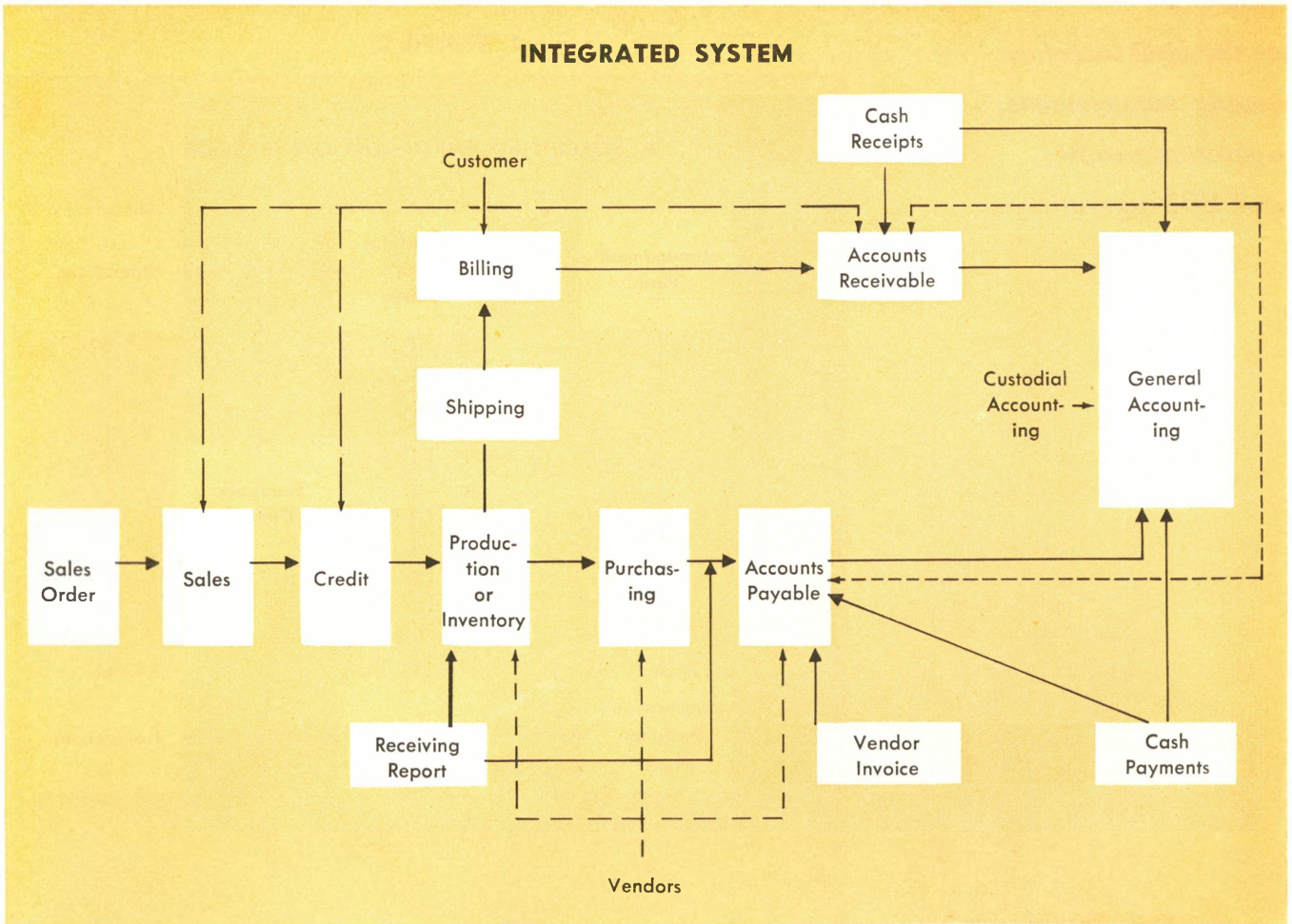
The director of information systems might be an accountant with data processing experience. Or he might be a systems man. Since the financial management and financing functions would be a separate organizational grouping with this sort of structure, the accountant may instead choose that path for career advancement instead of the information systems route.

Within the information framework, there should be an organizational separation among the systems design people, the data processing people, and the control group. This separation is important:

1. To provide an effective cross-check and control of the accuracy and propriety of changes made in the system
2. To eliminate access to equipment and records by people designing and programing the records
3. To promote efficiency through specialization. The capabilities, training, and skills required to carry out systems planning and programing, computer operations, and control differ widely.

[4] R. Sprague, *Electronic Business Systems*, The Ronald Press Company, New York, 1962, p. 158.

FIGURE 1



The systems design and development group would have the responsibility for translating management's operating objectives, policies, and plans into system flow charts and computer programs designed to generate timely and meaningful operating and management information. The systems must be designed to utilize, where applicable, management techniques developed to allocate available resources most effectively.

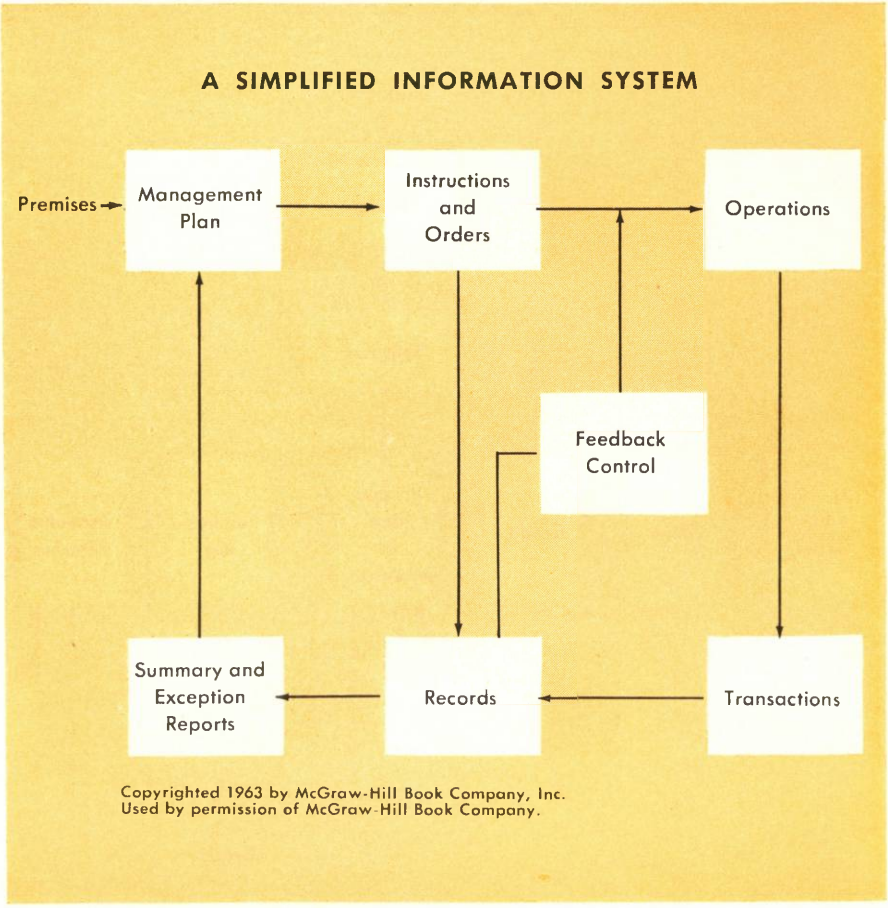
Systems group sections

The systems design and development group would be divided into two sections. The operating information systems section would have the responsibility for designing and developing systems to generate information about the physical flow of goods through an organization. The operating systems include procurement, production, and distribution; the information generated would be used for operating control rather than management control. The management information systems section would have the responsibility for designing and developing systems to provide information for management planning and control. Such information would be used to formulate strategy, allocate financial and manpower resources, and measure performance.

In broad terms, the systems design and development group should develop systems to process data originated by operating and management personnel in such a way as to give these personnel information to operate and manage the business effectively. In developing operating and management sys-

In developing operating and management systems, the systems group must act as the vital interface among management, operating people, and EDP operations.

FIGURE 2



tems the systems group must act as the vital interface among management, operating people, and EDP operations. Those who guide the creation of such systems must have knowledge of organization objectives, operating experience, and the ability to employ and evaluate the performance of specialists in the management sciences, operations research, and computer programing.

Data processing group

The data processing group would have the function of receiving data from operating and management personnel and processing the data in accordance with the system specifications. The group would be divided into two sections.

The data acquisition and control section would be responsible for all input into the EDP processing center, maintaining control of the data being processed until the final output had been transferred to the control group. Control would be maintained through the comparison of previously determined control totals, developed either by operating units or by the data acquisition and control section itself, with the output from computer processing. The section also would be responsible for developing processing schedules and for the conversion of input data to machine-readable form for electronic processing.

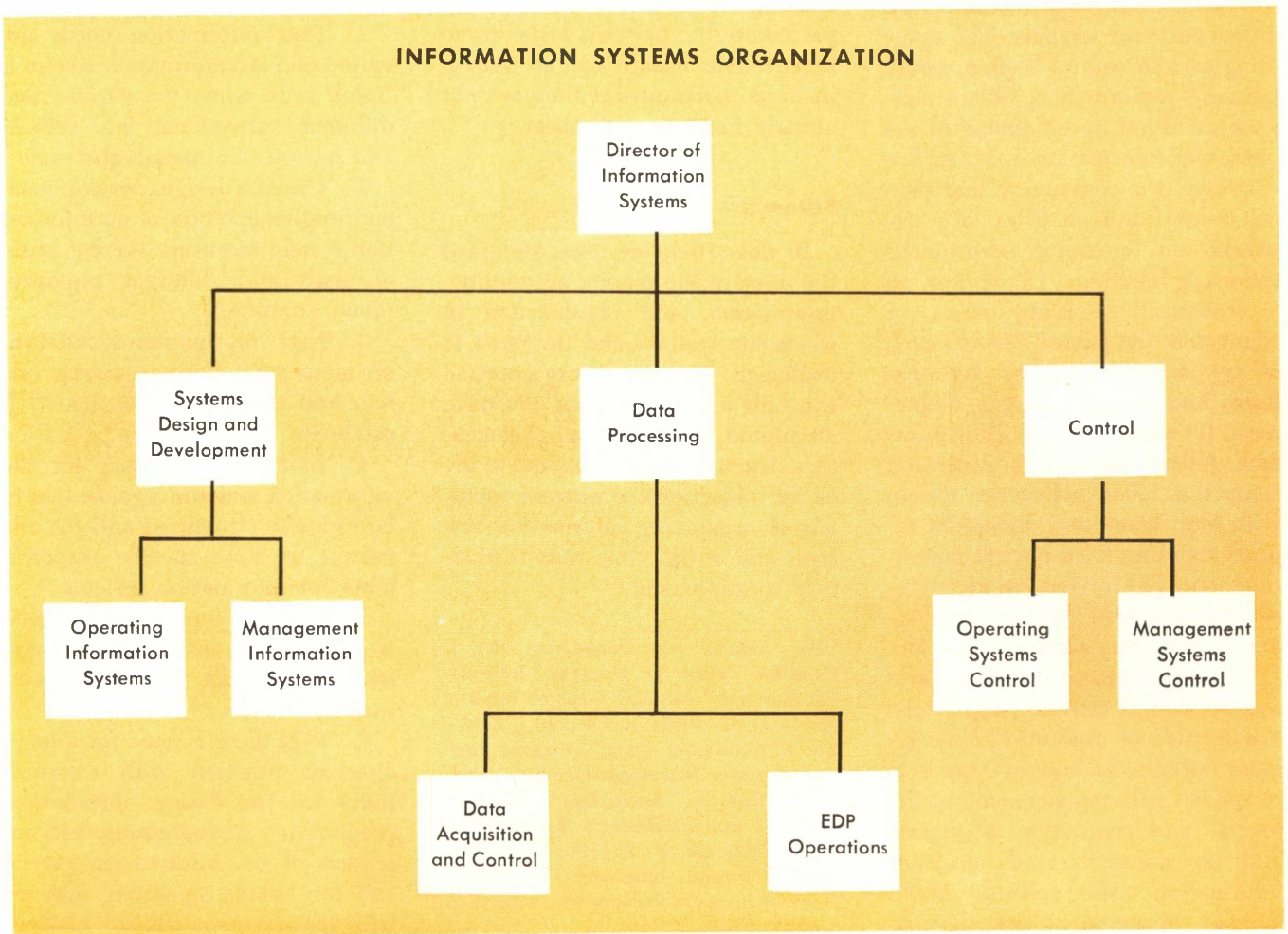
The EDP operations section, of course, would be responsible for the actual processing in accordance with processing schedules and operating instructions. The section also would be responsible for physical control of all completed computer programs, for the maintenance of all machine-readable files, and for the proper release of these programs and files for processing.

Control group

The EDP characteristic of system control rather than individual control was discussed earlier. System control is not automatic, however; there must be a control group. The control group may be defined as an organizational unit responsible for providing direction in conformity with the plan or for limiting variations from system objectives to allowable units. Specific functions of the control group would include the following:

1. Comparison of output with plan to detect unusual or abnormal items and to initiate corrective action by the organizational units responsible

FIGURE 3



User inquiries, requests, and criticisms about output reports and information provide a feedback mechanism to systems designers and programers.

2. Systematic sampling of individual outputs to determine whether the systems are functioning as designed

3. Handling of inquiries, requests, and criticisms of users, both external and internal, about output reports and information, thus providing a feedback mechanism to systems designers and programers.

The control group would be divided into two sections. The operating system control section would measure performance, isolate variances, and aid in replanning of the operating information systems. For example, it is common to find payroll control units in many large organizations. Such units perform the following functions: (1) review, on a statistical sampling basis, of changes in the payroll records such as pay rates, new hires, terminations, and changes in pay deductions; (2) comparison of labor hours and dollars on reports generated from the labor collection system with total hours and dollars on reports resulting from payroll processing; and (3) review of exception reports, followed by whatever action is necessary for the exception.

The management system control section should include people who are capable of presenting management information and who are able to consult with management on the format and frequency of reports and the parameters of necessary information. The section should include personnel knowledgeable in (1) performance measurement techniques such as profit planning, cost standards, budgetary control, and variance analysis; (2) quantitative analysis techniques such as capital budgeting and statistical sampling; and (3) financial reporting both for internal and external purposes. Such a mix of people may or may not be found in the existing accounting and finance departments, but personnel from these departments usually can be trained in these techniques if they are not already familiar with them.

Summary

In this article we have discussed the relationship among accounting, information, and organization in electronic systems and the need to challenge traditional organization concepts and procedures. We have attempted to develop an organization structure that overcomes many of the objections to current methods of organizing information systems and at the same time is practical to implement.[5]

Such an information systems organization can be implemented, however, only if top management is willing to break through the compartmentalized structure of traditional business organization and identify the information needs for all levels of management. If management can do this, it will have an information function which recognizes:

1. That information needs are varied and an information system is "total" only when the various and different subsystems are defined and related in a meaningful way

2. That the design, development, and implementation of an information system requires different kinds of skills and different organizational groupings

3. That information is not synonymous with the accounting system and the forms and reports it produces

4. That it is necessary for the information systems organization to be formally structured and for one person to have specific responsibility for information systems

5. That it is important to emphasize the design and control of systems rather than the data processing hardware

6. That there is need for a management function with responsibility for the design, installation, programing, reprograming, and operation of the information system and for linking operating systems with management control systems.

[5] For example, see Daniel, *op. cit.*; J. Dearden, "How to Organize Information Systems," *Harvard Business Review*, March-April, 1965; J. Diebold, "ADP—The Still-Sleeping Giant," *Harvard Business Review*, September-October, 1964; L. R. Fiock, Jr., "Seven Deadly Dangers in EDP," *Harvard Business Review*, May-June, 1962; and P. H. Thurston, "Who Should Control Information Systems?" *Harvard Business Review*, November-December, 1962.

Compensating stockholders of merging companies poses problems since the companies may vary in earnings potential as well as assets. This article outlines tests for measuring the fairness of distribution plans.

GRAPHIC TESTS OF EQUITY IN FINANCING CORPORATE COMBINATIONS

by Thomas H. Williams and Charles H. Griffin
The University of Texas

A GROWING number of companies are turning to mergers and acquisitions as a way of attaining rapid growth. The preliminary financial appraisal of an acquisition is relatively simple if the acquired company is to be operated as an entity without any consolidation of operations (or if it is to be liquidated to provide a tax loss). In these circumstances the financial appraisal consists essentially of a unilateral estimate of the new affiliate's aggregate net asset value.

If operations of the two companies are to be merged, however, each company must be analyzed, and the analysis must include relative earning capacities as well as assets contributed. Such an analysis is an important part of the acquiring company's planning if, as is commonly the case, the purpose of the merger is to enhance the earning power of both constituents. It is also an essential step in assuring fairness to all if there is to be continuity of interest in the combination on the part of both groups of stockholders.

This type of analysis is relatively complex, for it requires balancing subjective evaluations and projec-

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tions made by various interest groups and integrating them into a mutually acceptable plan. In this article we examine some of the more significant influences in the development of such plans, with stress on the question of equity to stockholder groups rather than on management planning. Tests for determining the relative equity of the original stockholder interest groups in the earnings of the combined company are described, and a graphic analytical technique for comparing security distribution plans is presented.

Analysis is relatively complex; it requires balancing subjective evaluations and projections made by various interest groups and integrating them into a mutually acceptable plan.

Unweighted Income Comparison

Year	Net Income Company X	Net Income Company Y
1961	$ 30,000	$ 10,000
1962	50,000	10,000
1963	80,000	20,000
1964	70,000	40,000
1965	50,000	70,000
	$280,000	$150,000
Five-year average	$ 56,000	$ 30,000

TABLE I

Basic considerations

When both groups of stockholders continue to retain a financial interest in the combined company, fundamental problems of equity exist. The key question is how relative allocations of future earnings compare with precombination distributions. To preserve the relative equities of the two groups in the new or surviving entity, the contributions of each company to the postcombination earnings must be estimated.

Frequently the past earnings history of each constituent company is used to project its contribution to future earnings. This history may or may not be a reliable indicator. Differing trends in the earnings of the two companies may upset the relationship between them, or existing trends may be reversed. In making projections, the analyst must take into account such factors as the economic maturity of the relevant industry, evidences of technological obsolescence and its implications, and the state of organization and degree of ferment in the labor force.

The assets transferred to the new or surviving corporation are also relevant, although consideration of these values ranks behind earnings. In evaluating net tangible assets, market values are preferred to book values because they are more closely related to earning capacity. Such intangible elements as managerial efficiency, competitive market conditions, and restrictive tariffs and other restraints determine the additional value generated by efficient application of the tangible assets; this value is implicitly provided for in the estimate of contributed future earnings.

Projection of earnings

The use of historical net income data in estimating earnings potentials is illustrated by the following example:

In a proposed combination of Company X and Company Y the average net incomes of both constituents for the past five years will be used in predicting earnings. As indicators of earnings potentials, these reported data may require certain adjustments. Adjustments should be made, for example, for unusual economic events that distort a single period's net income. Or if the net incomes for individual years are to be weighted in some manner in order to emphasize trend, an analysis and interperiod allocation of certain data (e.g., depreciation expense) may be required.

The net incomes of the two companies should always, of course, be measured in terms of the same accounting criteria. This may require adjustment of such items as inventory costing assumptions, depreciation methods, and such classificational distinctions as that be-

tween capital and revenue expenditures. In Table 1 on page 22 identical or equivalent measuring standards are assumed.

The unweighted averages of the net incomes of Company X and Company Y, as calculated in Table 1, may provide a reasonably accurate estimate of future earnings if the earnings of the two constituents remain relatively stable. If either company or both have shown significant progressive (or regressive) earnings trends during the period selected for study, the projection may be distorted. For this reason it may be wise to use an arbitrary weighting factor that gives increased weight to the net incomes of more recent years; this accents the directional trend of earnings.[1]

A weighted income comparison is illustrated in Table 2 on this page. The chosen weights are not predicated on specific trend values, yet they do allow for trends by emphasizing the most recent years' earnings. The data of Table 2 indicate a relatively more favorable earnings projection for Company Y, as compared to Company X, than did the unweighted computation used in Table 1.

Weighted Income Comparison

Year	Company X Net Income	Company X Weighting Factor	Company X Weighted Net Income	Company Y Net Income	Company Y Weighting Factor	Company Y Weighted Net Income
1961	$30,000	1	$ 30,000	$10,000	1	$ 10,000
1962	50,000	2	100,000	10,000	2	20,000
1963	80,000	3	240,000	20,000	3	60,000
1964	70,000	4	280,000	40,000	4	160,000
1965	50,000	5	250,000	70,000	5	350,000
		15	$900,000		15	$600,000
Five-year weighted average			$ 60,000			$ 40,000

TABLE 2

Foundation of a plan

To extend this illustrative example, let us assume that the weighted averages as determined in Table 2 are the best available estimates of the net income potentials of each constituent. Let us further assume that the net assets contributed by each company, at appraised market valuation, are as follows: Company X, $500,000, and Company Y, $200,000. Using these assumptions, Table 3 on this page summarizes the earnings projections and net asset contributions of the companies. These data provide a quantitative foundation on which to base an equitable plan of distributing securities and/or assets.

Securities distribution formulas

The stockholders of the merging companies may be compensated for their contributions to the amalgamation by a variety of means, including cash, senior securities, common stock, and combinations of these. The choice in a given instance will depend on the underlying objectives of the combining companies. Cash and senior securities (bonds and nonparticipating preferred stock) are frequently selected as the primary means of payment when one company is buying the other; residual equity shares, with or without an initial preference, are more often emphasized in cases of merger, when a bona fide continuity of stockholder interests is intended.[2]

Ideally, the relative interests implicit in the current earnings potential of each company should be recognized by distributing equivalent relative interests in postcombination earnings. On this basis, utilizing the data in Table 2, an equitable allocation would seem to call for future earnings to be distributed 60 per cent ($60,000 divided by $100,000) to the former stockholders of Company X and 40 per cent ($40,000 divided by $100,000) to the former stockholders of Company Y.

If the earnings contribution is the only criterion, equity can be achieved by issuing common stock in this ratio. However, it also may be desirable to issue senior securities to acknowledge the differing contributions of net tangible assets. These securities will provide a stable, minimal return in the postcombination period so long as "normal" profits are realized.

As the data in Table 3 show, the net assets contributed by Companies X and Y are in the ratio of 5:2, which is not the same as the ratio of their contributed earnings potentials of 6:4. It is evident, therefore, that to be equitable the plan of securities distribution must blend several types of securities or

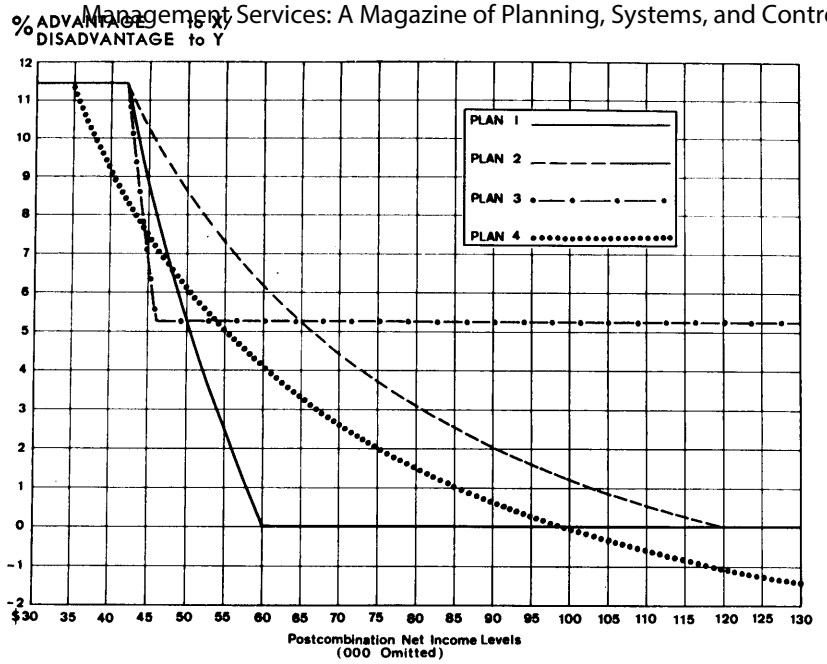
TABLE 3

Assets and Earnings Summary

	Company X	Company Y
Tangible net assets	$500,000	$200,000
Potential earnings (based on weighted average—Table 2	$ 60,000	$ 40,000
Estimated rate of return on net tangible assets	12%	20%

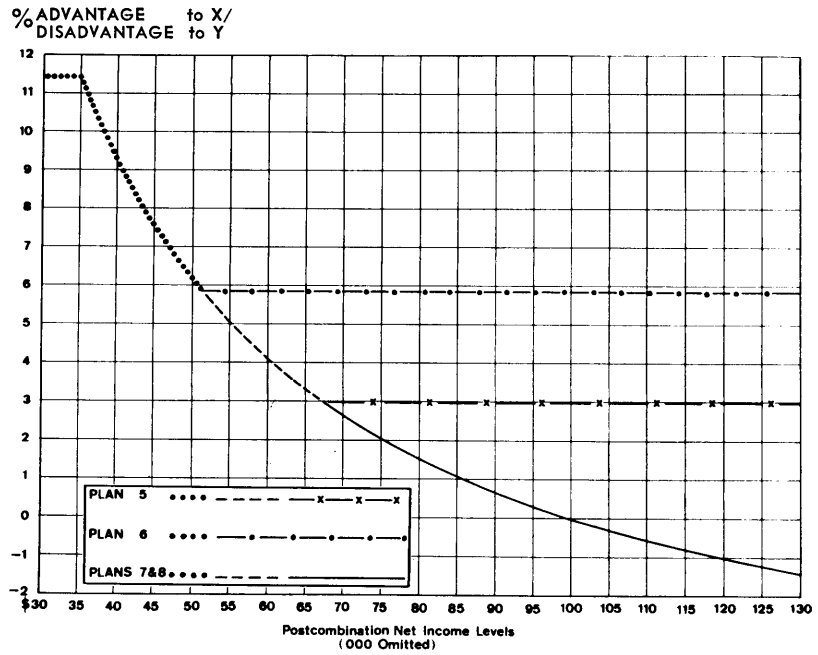
[1] This method is suggested by Clarence I. Drayton, Jr., Craig Emerson, John D. Griswold, and G. Richard Young, *Mergers and Acquisitions: Planning and Action*, Financial Executives Research Foundation, Inc., New York, 1963, pp. 86-88.

[2] If preferred stock that carries a voting right is used as a method of payment, the general conditions for a "tax free" reorganization are usually not violated.



Equity Implications of Distribution Plans in Table 4

FIGURE 1



Equity Implications of Distribution Plans in Table 5

FIGURE 2

provide for payment partially in assets to the former stockholders of the merged companies.

If securities only are to be distributed, an apparently feasible solution is to issue bonds and/or preferred stock for the value of contributed net tangible assets and to issue shares of common stock for the excess (or above normal) earnings potentials of the merging companies. A securities distribution formula of this type first compensates for the contribution of net tangible assets by assigning a priority claim on postcombination net income with a reasonable assurance of a normal return thereon. It also compensates for earning capacity through common shares, whose earnings reward will depend upon the extent to which the intangibles implicit in earnings potential actually lead to increased profits.

Testing distribution plans

The first step in creating an equitable distribution is to determine the type of senior security to be issued for the net tangible assets contributed by each company in the merger. The capitalization of the combination company will then consist of these shares plus additional shares of common stock to be issued for the capitalized value of expected future earnings in excess of a "normal" return on the contributed net tangible assets.

The number of common shares to be issued depends to a substantial extent upon the capitalization rate, or rates, selected. The validity of these choices can be checked by comparing the allocation ratio of postconsolidation earnings with the ratio of total estimated earnings potentials contributed by each company.

The effect of these alternative choices may be outlined and emphasized by a graphic representation of the variations in the relative advantage (or disadvantage) of each stockholder interest group at various levels of postcombination earnings over a relevant range of earnings. For example, if Company X contributes estimated earnings that are 60 per cent of the total present earnings potential of the combined company, a distribution plan that allocates to Company X 65 per cent of the net income of the new entity at a specified level of postcombination earnings obviously results in a 5 per cent advantage to the former stockholders of Company X and a 5 per cent disadvantage to the former stockholders of Company Y.

Figures 1 and 2 on this page graphically represent eight different distribution plans making use of various capitalization rates and various types of senior securities. Table 4 on page 25 presents the

Potential Distribution Plans
(using a single rate for capitalizing normal and excess earnings)
and Formulas for Relative Allocations of Future Earnings

	6% Cumulative, Participating Preferred Stock and Common Stock						5% Bonds and Common Stock	
	Plan 1		Plan 2		Plan 3		Plan 4	
	X	Y	X	Y	X	Y	X	Y
Capitalization and Normal Return Rate	10%		5%		15%		5%	
Calculation of Excess Earnings:								
Estimate of future earnings	$ 60,000	$ 40,000	$ 60,000	$ 40,000	$ 60,000	$ 40,000	$ 60,000	$ 40,000
Normal return on tangible net assets	50,000	20,000	25,000	10,000	75,000	30,000	25,000	10,000
Estimated return on intangible assets (excess earnings)	$ 10,000	$ 20,000	$ 35,000	$ 30,000	$ —0—	$ 10,000	$ 35,000	$ 30,000
Securities Distribution Plan:								
Senior security issued for net assets (as described above)	$500,000	$200,000	$ 500,000	$200,000	$500,000	$200,000	$ 500,000	$200,000
Common stock for capitalized excess earnings potential	100,000	200,000	700,000	600,000	—0—	66,667	700,000	600,000
Total stated or par value of securities	$600,000	$400,000	$1,200,000	$800,000	$500,000	$266,667	$1,200,000	$800,000

Formulas for Relative Allocations of Future Earnings:	Plan 1	Plan 2	Plan 3	Plan 4
Letting z = total postcombination earnings (before bond interest where appropriate). Relative advantage to X, disadvantage to Y =	11.43% for $z < \$42{,}000$; $\frac{\$240{,}000 - 4z}{15z}$ for $\$42{,}000 < z < \$60{,}000$; 0% for $z > \$60{,}000$	11.43% for $z < \$42{,}000$; $\frac{\$480{,}000 - 4z}{65z}$ for $\$42{,}000 < z < \$120{,}000$; 0% for $z > \$120{,}000$	11.43% for $z < \$42{,}000$; $\frac{\$30{,}000}{z} - .6$ for $\$42{,}000 < z < \$46{,}000$; 5.22% for $z > \$46{,}000$	11.43% for $z < \$35{,}000$; $\frac{\$400{,}000 - 4z}{65z}$ for $z > \$35{,}000$; $\lim_{z \to \infty} \frac{(\$400{,}000 - 4z)}{65z} = -6.15\%$

TABLE 4

basic data for four such plans, each of them using the same capitalization rate for both normal and excess earnings. In the first three of these plans 6 per cent cumulative participating preferred stock is issued for contributed net tangible assets; in the fourth plan 5 per cent bonds are issued for these assets. Table 5 on page 26 contains the basic data for the other four plans, each of which employs one capitalization rate for normal earnings and a different (and higher) capitalization rate for above normal (excess) earnings. Two of these plans provide for the issuance of 5 per cent cumulative participating preferred stock for contributed net tangible assets, and two of them provide for the issuance of 5 per cent bonds for this purpose.

Once a possible plan of securities distribution has been formally structured, it is informative to set forth the allocation of earnings to senior and residual securities for different levels of postcombination net income. At each level of earnings, the percentage interest in earnings allocated to each stockholder group may be calculated and the relative advantage or disadvantage determined. For each of the eight plans, compact mathematical formulas that provide a generalized basis for calculating the relative advantage and disadvantage for any given level of postcombination earnings are given in Tables 4 and 5. These calculations are then graphically illustrated in Figures 1 and 2.

The conversion of numeric data to graphic form is demonstrated by the example illustrated in Table 6 on page 27. Using the securities distribution data of Table 4 and assuming postconsolidation earnings of $80,000, allocations of earnings (both absolute and relative) are calculated in accordance with conventional accounting procedures. The advantage/disadvantage per-

Potential Distribution Plans
(using different rates for capitalizing normal and excess earnings)
and Formulas for Relative Allocations of Future Earnings

	5% Cumulative, Participating Preferred Stock and Common Stock				5% Bonds and Common Stock			
	Plan 5		Plan 6		Plan 7		Plan 8	
	X	Y	X	Y	X	Y	X	Y
Normal Return Rate	5%		5%		5%		5%	
Capitalization Rate	10%		20%		10%		20%	
Calculation of Excess Earnings:								
Estimate of future earnings	$ 60,000	$ 40,000	$ 60,000	$ 40,000	$ 60,000	$ 40,000	$ 60,000	$ 40,000
Normal return on tangible net assets	25,000	10,000	25,000	10,000	25,000	10,000	25,000	10,000
Estimated return on intangible assets (excess earnings)	$ 35,000	$ 30,000	$ 35,000	$ 30,000	$ 35,000	$ 30,000	$ 35,000	$ 30,000
Securities Distribution Plan:								
Senior security issued for net assets (as described above)	$500,000	$200,000	$500,000	$200,000	$500,000	$200,000	$500,000	$200,000
Common stock for capitalized excess earnings potential	350,000	300,000	175,000	150,000	350,000	300,000	175,000	150,000
Total stated or par value of securities	$850,000	$500,000	$675,000	$350,000	$850,000	$500,000	$675,000	$350,000

	Plan 5	Plan 6	Plan 7	Plan 8
Formulas for Relative Allocations of Future Earnings:				
Letting z = total postcombination earnings (before bond interest where appropriate). Relative advantage to X, disadvantage to Y =	11.43% for z < $35,000; $\frac{\$400{,}000 - 4z}{65z}$ for $35,000 < z < $67,500; 2.96% for z > $67,500	11.43% for z < $35,000; $\frac{\$400{,}000 - 4z}{65z}$ for $35,000 < z < $51,250; 5.85% for z > $51,250	Same as Plan 4 (Table 4)	Same as Plan 4 (Table 4)

TABLE 5

centage is based upon a comparison of the relative interest of each company in postcombination earnings (as enumerated in Table 6) with the relative interest of each in the estimate of contributed earnings potentials (Company X: 60 per cent; Company Y: 40 per cent) as previously defined. Thus, the relative equity implicit at this level of postcombination net income is computed for each of the four plans.

It is easier, however, to calculate these values by using the formulas suggested in Table 4:

Plan	Advantage to Company X/ Disadvantage to Company Y
1	0.00%, since $z > \$60{,}000$.
2	$\frac{\$480{,}000 - 4(\$80{,}000)}{65(\$80{,}000)} = 3.08\%$.
3	5.22%, since $z > \$46{,}000$.
4	$\frac{\$400{,}000 - 4(\$80{,}000)}{65(\$80{,}000)} = 1.54\%$.

With these formulas sufficient values may be calculated to complete the graphic representation of Figure 1. The four indexes of relative equity in the preceding example may be confirmed by noting the points at which the $80,000 postcombination earnings ordinate is intersected by each of the curves. The numeric data in Table 5 are translated into the graph of Figure 2 in the same manner.

The graphic presentation and the calculation by formulas produce equivalent results for any potential postcombination net income level. However, because the graph accents the relative advantage/disadvantage relationship more vividly, it might be preferred for a presentation to management.

The reader will note in Figure

1 that in the postcombination earnings range of $30,000 to $35,000, all plans yield an 11.43 per cent advantage to Company X and a corresponding disadvantage to Company Y. As earnings increase, the conditions of relative inequity change. For example, in the case of Plan 1, equity (the zero abscissa on the graph) is established at the $60,000 earnings ordinate, and it is evident that all postcombination earnings in excess of $60,000 preserve this equity. For Plans 2 and 4, equity is achieved at the $120,000 and $100,000 earnings levels, respectively. However, while in Plan 2 the equity index stabilizes at $120,000, in Plan 4 earnings in excess of $100,000 generate a new inequity with the advantage/disadvantage relationship reversed. A condition of equity is never achieved in Plan 3, although the inequity percentage ultimately stabilizes at 5.22 per cent.

For Plans 5 and 6 (in Figure 2), a stable condition of inequity is reached. The advantage to Company X and disadvantage to Company Y is 2.95 per cent in Plan 5; 5.85 per cent in Plan 6. Plans 7 and 8 have identical characteristics and are plotted as the same curve in Figure 2. There equity is achieved at the $100,000 earnings ordinate. Earnings in excess of this amount, however, produce a condition of inequity, with the advantage accruing to Company Y.

Calculation of Advantage/Disadvantage

Plan	Equity in Earnings		Percentage Interest in Earnings		Advantage to Company X/ Disadvantage to Company Y
	Company X	Company Y	Company X	Company Y	
1	$48,000	$32,000	60.00%	40.00%	0.00%
2	50,462	29,538	63.08	36.92	3.08
3	52,174	27,826	65.22	34.78	5.22
4	49,231	30,769	61.54	38.46	1.54

TABLE 6

Comment

From these graphic presentations several conclusions can be drawn:

1. Since the ratio of the net tangible assets contributed by the two participants in the combination is different from the ratio of their earnings potentials, it is impossible to issue a single type of security for distribution to the two groups and still preserve equitable interests in postcombination net income over the entire relevant range of postcombination earnings. For example, a distribution of common shares only would be depicted graphically as a straight line. If this type of security were issued in the ratio of contributed earnings potentials, the two companies' contributions of net tangible assets would not be compensated equitably. If, on the other hand, common shares were issued in some other ratio, a permanent (and constant) net income advantage would accrue to one of the former stockholder groups.

2. As Figure 1 demonstrates, any meaningful definition of "equity" must be related to a specific postcombination net income level. It is evident that equity may be attained at different net income levels with different plans. Commonly applied tests of equity often fail to take into account the significance of the relevant range of postcombination earnings.

3. It is possible to conclude from Figure 2 that the use of different rates for capitalizing normal and excess earnings will not necessarily yield a stable equity relationship such as was ultimately achieved under Plans 1 and 2. Failure to attain equity is a result of the fact that the ratio of earnings on net tangible assets may not coincide with the ratio of earnings on the unrecorded intangibles which are determined (created) in the process of capitalizing excess earnings.

4. It is obvious that the use of bonds (or of nonparticipating preferred stock, which functions in the same way for purposes of this type of analysis) will not result in an equitable distribution plan over the relevant range of postcombination earnings, although it may produce equity at a single level of earnings. Plans 4, 7, and 8 also indicate that the capitalization rate is not an especially critical element when bonds are issued for net assets. On the other hand, the preference rate of return assigned to the bonds or nonparticipating preferred stock will materially affect the degree of inequity of such a plan at different levels of postcombination net income.

Conclusion

Rules that rigidly prescribe the security types and the capitalization rate limits to be used in a securities distribution plan for participants in a corporate combination may result in inequity for one group or the other. For a meaningful appraisal of the equity or inequity of alternative arrangements, the effect of the plans on distribution of postcombination net income must be studied. Conclusions should be reached concerning the degree of risk that must be accepted by various stockholder groups if the advantages from combination are to be realized.

The implications of alternative courses of action may be analyzed mathematically and accented by graphic presentation. A graphic analysis of the type illustrated in this article should be especially useful in highlighting the effects of postcombination earnings distributions upon the equity of the various stockholder interests.

Properly solicited and used, the equipment and systems proposals of computer manufacturers can be a valuable tool in preparing an installation. Here are six guideposts to ensure the best help—

EVALUATING PROPOSALS FROM COMPUTER MANUFACTURERS

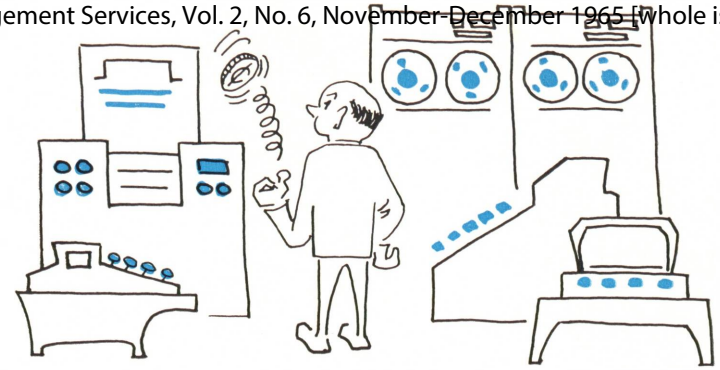
by Kenneth C. Cole
Haskins & Sells

TO ALLEVIATE management's growing paperwork problem, computer manufacturers offer a large number of mechanized remedies in all shapes, colors, sizes, and prices. These remedies promise great speed and accuracy in data handling and report preparation as well as dollar savings.

Such an abundance of sparkling computer prescriptions confronts the manager with a dilemma: "Which equipment should I choose?" "What is best for my company?" Thorough analysis of the dozens of computer systems on the market today is a difficult task. Conversely, the problem may be misleadingly easy to resolve by deciding to order the newest model announced by the supplier with which the company financial officer or president is acquainted through previous business dealings.

It is obvious, of course, that a decision to invest several hundred thousand dollars should be made only after thorough analysis of several types of available equipment. If properly used as part of the total computer study, one tool stands out as being particularly well suited for the manager's use in answering the question, "What is best for my company?" This tool is the equipment and systems proposals submitted by interested manufacturers. However, the contribution this tool will actually make to the overall computer study depends on several factors that are not always given sufficient emphasis in discussions of equipment selection. These factors are as follows:

1. The objectivity with which



Thorough analysis of the dozens of computer systems on today's market is a difficult task.

the overall system evaluation is conducted by the user company

2. The extent to which appropriate company personnel participate in the study
3. The type of data furnished by the company to the computer manufacturers
4. The scope and depth of the manufacturers' studies
5. The experience of the manufacturers' systems personnel
6. The competence of company personnel to evaluate the proposals received and to reach a reasonable conclusion.

Objectivity

An important consideration in determining the value of manufacturers' proposals in the computer study is whether management personnel at all levels are truly objective and really want to choose the most suitable equipment regardless of supplier. If an advance decision has already been made to install a specific supplier's system, only that supplier should be asked to submit a proposal as a part of the total computer study. It is unfair under these circumstances to ask other manufacturers for proposals. There is no justification for requiring them to devote substantial time to systems analysis and proposal preparation if the only purpose is to enable the user company to obtain free systems advice from a variety of qualified sources.

A decision to continue a long-time association with a particular supplier or to select a highly publicized system with minimum evaluation of competition is likely to be a questionable one. Admittedly, a company may have the highest possible regard for the quality of personnel, equipment, and service of one supplier. Management may be uncomfortably aware that, once the decision is made to "take a look at a few others," there will be a procession of EDP sales and systems personnel requesting appointments for equipment demonstrations and demanding equal time for orientation seminars.

Nevertheless, an EDP decision is one of major magnitude to most companies. A sound decision usually requires consideration of a variety of choices. Most business-oriented computer systems are classified as general purpose. Not one of them will exactly fit a company's needs. The problem is to find the general purpose equipment that comes closest to matching the specific current and future requirements of the user. This task warrants full consideration of more than a single course of action.

Company personnel

The caliber of company personnel engaged in a computer study will affect the usefulness of the manufacturers' proposals. Too often important data processing decisions, committing a substantial portion of a company's budget, are made by lower-level management personnel because of top management's failure to concern itself with the problem. Many unsatisfactory experiences with computer ventures can be traced to general management's reluctance to accept responsibility and participate personally in the EDP program. Despite innumerable articles warning of just such pitfalls, some executives erroneously assume that their personnel are experienced enough to administer an electronic computer program. The job of analysis is delegated to persons who are not properly equipped by training or background to make an evaluation. Their work is not reviewed by higher management or by outside professionals.

Unless general management becomes directly involved, particularly in designating the management problems the computer is expected to solve and in selecting specific applications, it will find

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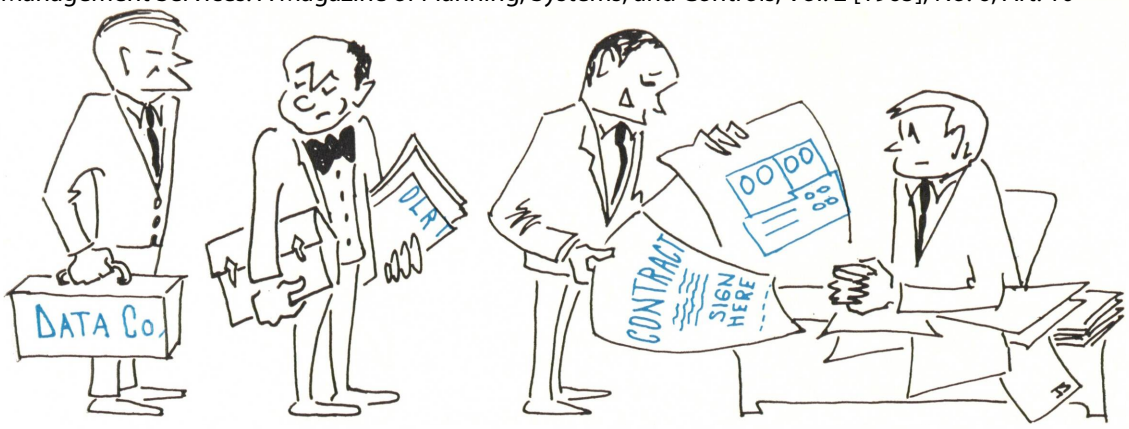


Once the decision is made to "look at a few others," management had best prepare itself for a procession of EDP sales and systems personnel.

that decisions of considerable financial magnitude are being made by lower-level personnel who are not familiar with the company's long-range plans. Top management participation is important in the proposal-preparation and proposal-evaluation stages of the study. Executives can gain valuable insight into equipment capabilities, potential solutions to company problems, and the relationships of equipment costs and labor savings by discussing directly with the manufacturers' representatives the methods by which the company's data processing goals can best be attained. Management can and should find the time to get involved; indeed, it must find the time.

Specifications

A computer manufacturer can write and present a useful proposal only if the prospective customer gives him adequate specifications. He must have information about the applications to be converted to the equipment, the structure of the organization in which the EDP function will operate, and the expected future growth. The exhibit on page 33, taken from a set of specifications actually used by a large company as the basis for obtaining manufacturers' proposals, outlines the sort of information that should be included.

Specifications must be prepared in such a way that all proposals will be directed toward the same goals and all of them will contain directly comparable information. A company seeking manufacturers' proposals that will give it maximum assistance in evaluating the available choices will also encourage the manufacturers to discuss the specifications further and to request more detailed information if necessary.

By this time, of course, the company should have conducted an extensive systems study of its own to identify those applications that are truly appropriate for computer processing. Existing clerical or punched card processing procedures should be examined thoroughly for possible simplification, or even elimination, before they are included in the computer plans. Even more important is the necessity to analyze other areas of company operations that may have been overlooked in previous mechanization studies. The objective of installing a computer should not be merely to convert existing punched card procedures but rather to obtain additional benefits—for example, in information flow and analysis for decision making—in other areas not yet explored.

Soliciting proposals

In presenting specifications to equipment manufacturers it is a good idea to invite the manufacturers' representatives to an orientation meeting. At this meeting they should be told about the general data processing problems, the applications to be converted, and the approximate volumes encountered. Then each manufacturer should be asked to indicate whether he wishes to submit a proposal. Those who do should be given written descriptions of the company organization, current personnel assignments in the departments affected, the cost of existing office equipment, and detailed data about the file sizes, volumes, and report formats of the major applications to be converted.

It is important for the customer company to specify precisely what the proposals should contain, defining the required scope and degree of detail, such as procedural flow charts, cost data, and savings projections, so that all proposals will be comparable. The manufacturers will probably need addi-

Too often important data processing decisions are made by lower level management personnel while top management fails to concern itself.

tional information and assistance from the prospective customer as they progress with the preparation of their proposals. Usually one man in the customer company is designated to perform this consultation function in order to avoid disrupting the entire office.

If the manufacturers are properly familiarized with the company's problems, the recommendations made in their proposals should demonstrate accurately how the equipment of each will fit the customer's needs. If they lack definitive specifications, the computer manufacturers will be able to submit only proposals with standard information applicable to any and all potential customers. They cannot prepare proposals tailored specifically to a particular customer.

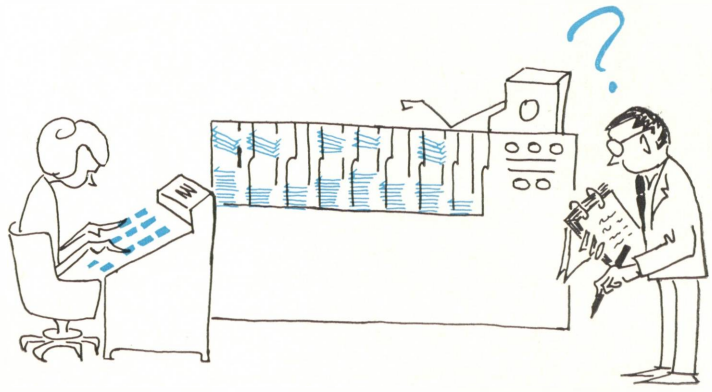
Manufacturers' studies

Even if the company under study gives the manufacturers considerable information about its operations, there still may be a marked difference among the manufacturers in the extent to which these data are utilized. The customer company should note how much thought and analysis each manufacturer has put into his proposal.

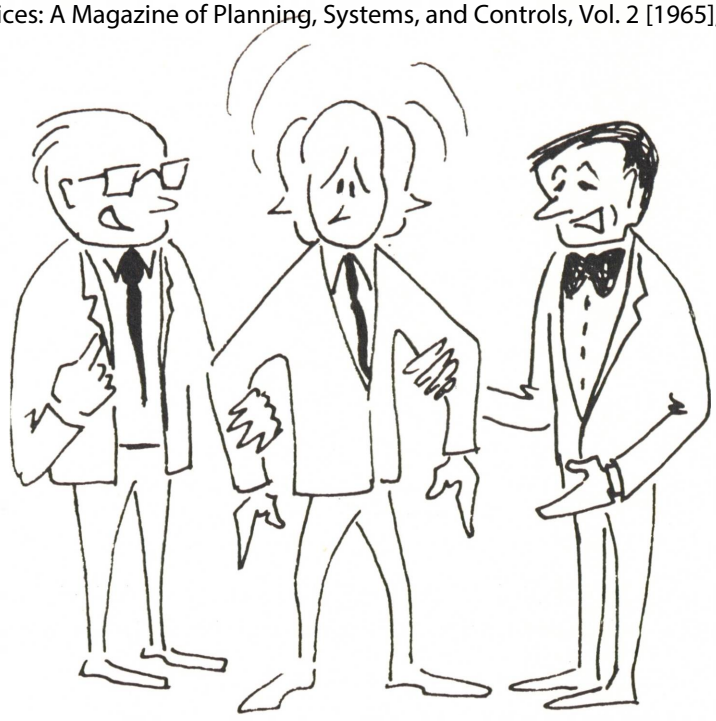
Some proposals show clearly that the suppliers have given considerable study to the information provided them and have attempted to understand fully the interrelationships of various functions and data and their less obvious implications. Such proposals may include detailed schedules specifying not only how but also when each operation could be done.

Work scheduling is normally a critical part of a data processing operation. A supplier who has not thoroughly explored the scheduling problems may be recommending a system that is actually incapable of meeting processing and reporting-time requirements even though its overall utilization falls within the allowable percentage. To be useful, proposals should include provision for processing a peak day's work as well as that of an average day. Problems that arise should not be passed over with a remark such as, "No problem; it can be solved during implementation." In the end the "no problem" issues may prove to be among the most costly and time-consuming to resolve.

In short, the scope and depth of the analysis conducted by manufacturers' personnel and the amount of time and thought they have apparently given to the company's problems should be taken



Existing punched card operations should be examined thoroughly for simplification — even elimination.



A small core of highly qualified people are being used in the education of thousands of computer users.

into consideration in weighing the content of proposals.

Manufacturers' personnel

There is a decided shortage of experienced computer systems analysts, a shortage that can be expected to intensify as the number of computer installations grows. Equipment suppliers as well as users suffer from this shortage. As a result, relatively inexperienced personnel may be developing the details of a manufacturer's proposal.

A customer company should attempt to evaluate to some degree the technical competence of the persons who made the study, formed the conclusions, and submitted the recommendations. The advice of these persons is reflected in the manufacturer's proposal. Whether their advice really represents a sound application of the manufacturer's equipment to the company's problems depends in large part on their background and experience. Since these same men are likely to be the ones most directly responsible for assisting user personnel in planning the computer system to be programed, they will be instrumental in realizing the anticipated benefits. If there is any doubt of their technical competence, this doubt should be extended to the contents of their proposal.

The manufacturer's local account representative is often the key man. He could be a recent college graduate who has just completed his orientation course.

Training burden

All the major computer manufacturers have invested heavily in programs for customer education and training. They realize that if the market for computer equipment is to expand, there must be an adequate supply of personnel capable of effectively utilizing the equipment offered. Since other possible facilities for training, such as public schools, colleges, and private trade schools, have just begun to establish programs in this field, the

burden until recently has fallen almost completely on the manufacturers.

The manufacturers employ large staffs of persons with the highest qualifications. These qualifications include intimate knowledge of the electronic components of the hardware, thorough familiarity with the techniques of programing applications for the equipment, outstanding reputations in teaching and research, and valuable work experience in a number of major industries. This reservoir of talent is being used in the education of thousands of computer system users. Without this investment there would be few persons qualified to serve in the computer field today.

All the EDP manufacturers employ personnel who are capable of giving material assistance to a potential user during the competitive equipment evaluation and during the other stages of a total feasibility study. However, there are two problems. There are not enough experts to go around, and there often is not sufficient time to do a thorough job of analysis for every prospective user. The manufacturer must use the personnel who are available at the time and location concerned, and manufacturers' representatives vary in the scope and level of their competence.

Regardless of the vast storehouse of knowledge available in the manufacturer's entire staff, it is the local account representatives who are responsible for applying the portion of this knowledge most applicable to each user's problem. Some representatives are experts on how the equipment operates but are less familiar with specific industry applications. Others may have many years of experience in the use of magnetic tape systems but may be beginners in the field of random access. One person may be a recent college graduate who has just completed his company's orientation courses. Another may be a veteran systems man—but with years of experience in punched card accounting, not EDP systems.

There is no question that the manufacturers on the whole have done a praiseworthy job and are continuing to do so. They are continually improving their own staff training programs in order to give their personnel the knowledge that will be of greatest value to the computer user. Nevertheless, a company reviewing manufacturers' proposals should attempt to examine the backgrounds of the men assigned to the job at hand as one means of ascertaining how much reliance can be placed on their recommendations.

It is all-important that the proposals received by the company be reviewed by personnel who are qualified to make an intelligent analysis. If all the previously mentioned rules have been followed and the manufacturers have presented meaningful proposals, a valid evaluation of their content is necessary.

Analyzing manufacturers' proposals in such a manner that the

OUTLINE OF AN ACTUAL SET OF SPECIFICATIONS FOR MANUFACTURERS

I. Letter to computer manufacturers inquiring whether they are interested in submitting proposals

II. General description of the company, its activities, and its organization

III. Outline of present data processing equipment and applications

IV. General description of the company's plans for data processing in the future:
- Anticipated date of installation of new system
- List of general applications to be processed on the new system
- Major considerations to be used in analyzing and comparing competitive proposals
- Statement of processing schedules within which the work must be completed
- Deadline for submitting proposals
- Anticipated decision date
- Name of company employee with whom computer manufacturers should work

V. Flow charts of major applications:
- Short description of the purpose of each run
- Estimated number of input transactions
- Estimated number of master file records
- Estimated number of output records
- Estimated number of print lines
- Estimate of volume growth

VI. Description of the input, output, card formats and report layouts, and master files to be used in the computer runs:
- Name of file, card, or report
- Number of records or lines
- Length of file
- Items within a file, card, or report

VII. Statement of specific information relating to various subjects to be forwarded by each manufacturer:

A. Number of hours within which all processing will be completed
- Proposed schedule of processing

B. Statement of the type of charts and degree of detail of work sheets required to be submitted to support the proposal

C. Equipment hardware:
- Computer system proposed
- Monthly rental
- Definition of rental shift
- Alternate lease plans
- Extra shift charge per hour
- Purchase price
- Purchase option plans
- Cost per reel of magnetic tape and/or disk packs
- Estimate of number of reels and/or disk packs required

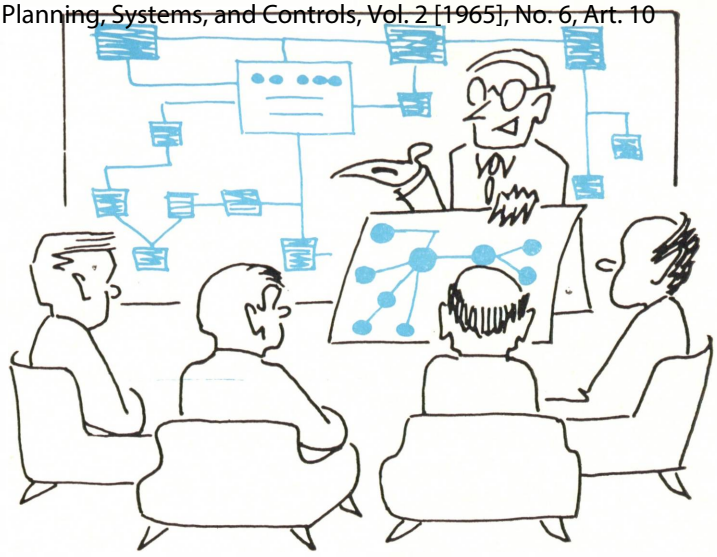
D. Estimated delivery schedule

E. Order cancellation terms

F. Installation requirements:
- Electrical power
- Flooring and enclosure
- Space
- Air conditioning and humidity control

G. Amount of qualified systems and programing help furnished:
- Type of programing classes available and locations thereof
- On-site training classes?
- Nearest testing and debugging facilities
- Amount of machine time to be made available without charge for debugging purposes before and after system delivery
- Description of utility programs and the assembler and/or compiler programs with stated availability dates

H. Identification of installation of similar equipment in the area that would be available for operational support in case of emergency



The object: Not merely to convert existing punched card procedures but rather to obtain additional, new benefits.

The importance of proposal analysis can hardly be overemphasized. The entire proposal can be a waste of time if information presented is not properly interpreted and analyzed.

important factors to be considered are set forth clearly and management has the data needed to make a wise decision is a difficult task. A number of articles have discussed the evaluation procedures themselves; there is no need to go into them here. Companies without systems staffs of their own often should seek outside assistance in making the evaluation. Even when qualified personnel are available within the company, it is sometimes advisable to retain private consultants to ensure objectivity and minimize any internal politics that may exist.

The importance of the proposal analysis can hardly be overemphasized. The entire proposal program can be a complete waste of time if the information presented is not properly interpreted and analyzed.

Conclusion

Manufacturers' proposals can be highly useful to a company engaged in studying various electronic data processing systems. Properly used, these proposals should serve as a basis for evaluating how well the available systems hardware will fulfill the company's data processing requirements. Full benefits from their utilization, however, will be realized only when the suggested guidelines have been fully considered. These guidelines may be summarized as follows:

1. Be sure that the true purpose of gathering proposals is to provide a basis for an objective analysis of competitive systems.
2. Get general management directly involved at an early stage—once the decision has been reached to make an extensive investigation of competitive systems.
3. Furnish the manufacturers with all pertinent data so that the content of the proposals can be of the greatest possible value. The investment of time in discussion and explanation should reap high returns through improvement of the proposals submitted.
4. Note the scope and depth of study the manufacturer has applied to the information furnished him. Has he fully understood the problems? Has he recommended a workable system?
5. Attempt to evaluate the qualifications of the manufacturers' systems personnel. What are the scope and level of their technical competence?
6. Determine whether company personnel are qualified to interpret and analyze the proposal data. If not, is outside consulting assistance desirable?

Often many of the benefits of an EDP installation are offset by poor cost control measures in the keypunching operation. This article describes an effective system—MTM—for improving such control—

CONTROLLING THE COSTS OF KEYPUNCH OPERATIONS

by Richard Paulson

THE DECISION to install a computer is a major one in most organizations. Typically a great deal of time, thought, and effort goes into the feasibility study, the selection of the equipment, and the systems design. Yet in all too many cases little or no attention is given to the problem of controlling EDP operating costs after the system goes on line.

Even small computers are expensive pieces of equipment by office machine standards. Their supporting staffs are costly, too. Purchase or rental of EDP represents a sizable investment. To produce a fair return on that investment, machine time must be fully utilized. So must the time of keypunch operators and other personnel.

Thus, it might seem obvious that one of management's first steps after installing a computer should be to set up some sort of work measurement and cost control system to ensure that it will get a fair day's production for a fair day's pay. Yet more often than not top management delegates the task of establishing controls to first-line supervisors, who seldom have the time or background to explore the techniques available and therefore have to settle for an inadequate system—or none at all.

This need not be the case. It is neither difficult nor costly to apply a fair, accurate, and consistent work measurement and control system to any keypunch operation anywhere in the world today. Keypunching and other clerical tasks can be easily measured and controlled by means of predetermined time systems. This article describes one of the most widely accepted predetermined time systems, MTM[1] (Methods Time Measurement), and explains how it might be applied to an EDP keypunch operation.

What MTM is

By using predetermined motion times, analysts can avoid the psychological and other disadvantages of time study by a stop watch. A predetermined time system is a listing of all the basic motions that a human being can or will perform in doing factory or office tasks with a

[1] Delman W. Karger and Franklin H. Bayha, *Engineered Work Measurement*, The Industrial Press, New York, 1957.

STANDARD DATA DEVELOPMENT

DESIGNATION	Keypunching and Verifying Machines - I.B.M.-Models 026-027 and 056 (Set Up - Remove Punched Cards From Stacker)
STARTS WITH	Reach To Cards
ENDS WITH	Removed Cards Held in Hand At Work Area
INCLUDES	See Element Analysis
LIMITATION	

DESCRIPTION — L.H.	FREQ.	SYMBOL	TMU	SYMBOL	FREQ.	DESCRIPTION — R.H.
To cards		R 20 B	18.6			
		G 1 A	2.0			
To work area		M 20 B	18.2	R 14 A		To cards
Better control		~~G 2~~	-	G 1 A		Grasp
			38.8			
Rounded to			39.0			

DATE	BOOK	SECTION	EDP
PAGE 1 OF 1		CODE	

EXHIBIT 1

standard performance time for each motion. There are several of these systems; MTM is undoubtedly the most widely used.

It would be neither practical nor feasible to elaborate on all the aspects of MTM in this article. (Many books fully cover the subject matter.) In essence, it is a system whereby standard time values have been assigned to the performance of such basic motions as reach, grasp, and release. These standard time values are performance times for an average worker of average skill exerting average effort. To apply this system, the analyst lists the motions that an operator should use to perform his job, assigns the proper time value to each motion, and adds up the times to arrive at a normal time for the operation.

The time values are stated in TMU's (Time Measurement Units); 1,666.7 TMU's are equivalent to one minute of time. Thus, every elementary motion such as a hand reaching to an object or the grasping of an object has a TMU value, which will vary with the distance of the reach, the type of object grasped, and the like.

Standard times have also been calculated for various common combinations of the basic motion patterns. These times, known as second-level data, make the application of MTM much easier. An example of a motion pattern that occurs frequently enough to be considered second-level data is shown in Exhibit 1 on this page.

A few years after the publication of the first MTM textbook[2] in 1948 a group of management consultants formed the MTM Association for Standards and Research to conduct basic and applied research in the field. The association and various consulting firms have arrived at second-level data in a number of fields of endeavor and are continually adding to the supply. The existence of sufficient second-level data in a particular field such as keypunch enables any qualified MTM analyst to establish performance standards in short order.

To illustrate the technique by means of a hypothetical case, let us assume that an organization found it necessary to establish an EDP control center consisting, in part, of 25 keypunch/verify units. It soon became apparent that there was enough work to keep three shifts busy full time, but the third shift would consist of only 10 operators while the other two had 25 each (for a total of 60 operators).

In order to plan and schedule the work load, departmental supervision decided it would be wise to start keeping records of the department's output. After a few weeks they found that they were punching approximately 120,000 cards per day on the average (which broke down to 2,000 cards per day per operator or 250 cards per hour per operator). So they job loaded and scheduled on this basis.

They realized, of course, that this method of job loading and scheduling was not the best or most accurate. They had not taken the efficiency of the operator into account, nor had they attempted to break down the job by delays, rework, set-up time, etc. But the economics of the situation did not seem to justify a time study of

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[2] H. B. Maynard, G. J. Stegmerten, and J. L. Schwab, *Methods-Time Measurement*, McGraw-Hill Book Company, New York, 1948.

. . . others go home sick. And production suffers.

every job, nor did they wish to disrupt the department by having random sampling studies made on their operators; some operators become highly nervous when they know they are being observed, while other operators go home sick. As a result production drops off considerably. Under these conditions this department continued to operate with a control system that was admittedly inadequate but that was considered better than nothing at all.

Finally the organization was alerted to the availability of standard data and proceeded to utilize it in establishing standards for all keypunch operations. After 10 days of analyzing the 400 categories of operations, they arrived at a total of 20 different standards that covered all 400. (Many of these 400 were alike in content although not necessarily in scope.) Within six weeks the department had established a control function capable of improving productivity and reducing excess costs by between 20 per cent and 30 per cent.

How it works

One of the ways in which such a control system might work is illustrated in Exhibit 2 below and Exhibit 3 on page 38.

Exhibit 2 shows a typical weekly production report sheet. Each day the operator would record the total number of cards punched and/or verified and the number of setups. The back of the form would be used to report any nonproductive time. At the end of the week these reports would be collected by the representative of the department responsible, in this case the industrial engineering department, and the earned hours would be computed by totaling up the number of cards punched and/or verified and multiplying the total by the standard for the jobs.

The totals at the bottom of each production report for each operator would then be transferred to a

EXHIBIT 2

WEEKLY PRODUCTION REPORT

ORGN. NO.	GROUP NO.	SUB GROUP NO.	WEEK ENDING	PAGE / OF
W2	X4Z		4/4/65	1 / 1

GROUP NAME: KEYPUNCH

SUPERVISOR'S APPROVAL: JOHN DOE

EMPLOYEE NAME: BETTY DOE

OPERATION NUMBER	PRODUCTION COUNT						TOTAL PRODUCTION	HOURS EARNED
	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY		
P1	75						75	.150
V1		942	775				1717	.429
P2	150				350		500	1.500
V2	331		15		1045		1091	2.410
P3		50					50	.115
P4		615			16		631	1.388
V4		225			313		538	1.289
V5		11		H			11	.026
P6	36			O	72		108	.281
V6			16	L	34		50	.140
P7		40	19	I			59	.177
V7	29			D			29	.093
P8			210	A			210	.588
V8			30	Y			30	.090
P9	260						260	1.040
								10.716
#S/J	9	11	13	—	14		47	1.040
HOURS WORKED								11.756

	1	2	3	4	5	6	7	8
WEEKLY TOTAL	GROSS HOURS	REWORK	NON-PROD.	LEAD TIME	NON-MEAS.	MEAS.	STD. HOURS PROD.	EMPLOYEE PERF.
→	26.0	2.1	—	—	—	23.9	11.8	49.9

ACTIVITY REPORT—MTM PROGRAM

WEEK ENDING 4/4/65 SECTION KEYPUNCH DEPARTMENT A SUPERVISOR J. DOE

COLUMN	1	2	3	4	5	6	7	8
EMPLOYEE	GROSS HOURS	REWORK	NON-PROD.	LEAD TIME	NON-MEAS.	MEAS.	STD. HOURS PROD.	EMPLOYEE PERF.
BETTY	26	2.1	-	-	-	23.9	11.8	49.9
JANE	30.2	-	4.0	-	20.9	5.3	1.9	35.8
MARY	30.0	-	-	-	22.7	7.3	2.3	31.5
JUNE	31.3	-	4.8	-	-	26.5	6.8	25.7
ALICE	21.8	1.5	0.3	-	16.5	3.5	0.4	11.4
TOTALS								
				COLUMN 11 COVERAGE		COLUMN 10 RATING		COLUMN 9 PERF.
				85.1		59.0		74.0

- ETC. FOR TOTAL OF 60 OPERATORS

60 OPERATORS →

EXHIBIT 3

Adequate control of keypunch operations—or of any other clerical task—hinges on the installation and maintenance of a proven work measurement program on an individual basis. The resulting information can give control reports for all levels of management.

form such as that shown in Exhibit 3. This form would show the performance figures for all operators on each shift ranked by performance from highest to lowest. A similar sheet could be provided to show a combination of all three shifts and hence departmental performance.

Then the first-line supervisor would have a visual picture of the productive capacity of each individual and of the entire department. He could see at a glance which of his operators were performing productively, which were spending too much time on nonproductive work, which were taking too much rework time, etc. He could identify his low performers and take corrective action to improve their performance. He could job load his department more effectively, for example, by assigning high-priority tasks to his high performers and long-lead-time tasks to the low performers. No longer would he need to be alarmed by jobs that had never been run before, for a standard could be applied in a matter of minutes before the start of the run and the job then could easily be scheduled accordingly.

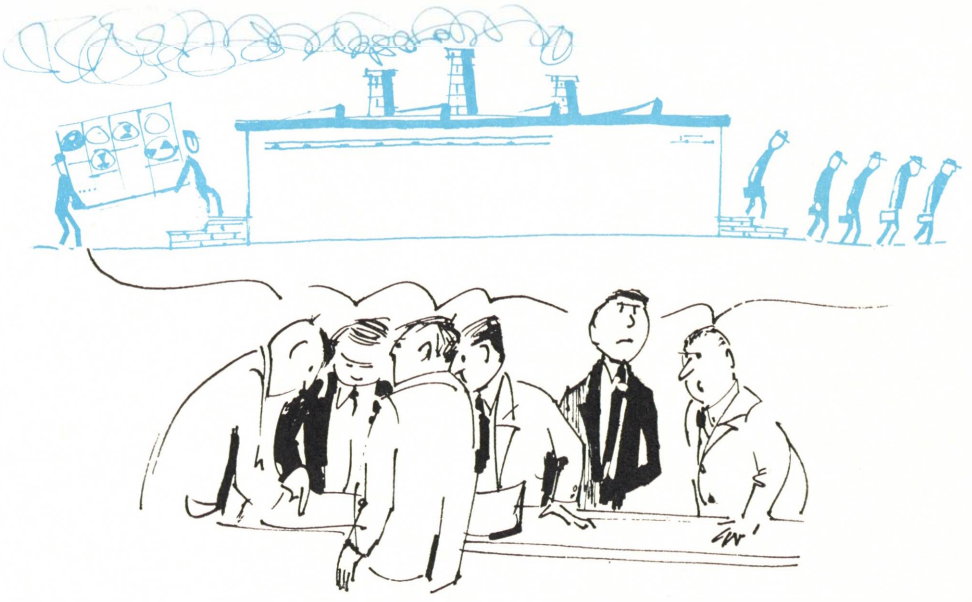
In short, the department supervisor then would have adequate measurement and control. Tighter overall control also would be provided, for this information could be compiled in the form of a cost and performance summary report suitable for top management review.

Conclusion

In the final analysis, adequate control of keypunch operations or of any other clerical task hinges on the installation and maintenance of a proven work measurement program on an individual basis. From the resulting information, control reports can be provided for all levels of management.

Basically, the first-line supervisor should be interested only in a report dealing with the weekly performance of his operators and how they are spending their time. Higher management, on the other hand, should be concerned only with the efficiency of the department and the total cost of department operation.

With such controls, management at all levels will be in a position to plan and schedule work loads systematically, to evaluate employee performance fairly, to improve quality as well as quantity of production, and—last but by no means least—to improve overall profits (or, in a government agency, to reduce or stabilize taxes).



Congressional hearings have highlighted the great fear of automation's opponents—unemployment!

A system may be logically perfect—but it still must be administered by all-too-human beings. Here are some ways to minimize the human problems in systems design and change—

HUMAN FACTORS IN SYSTEMS DESIGN

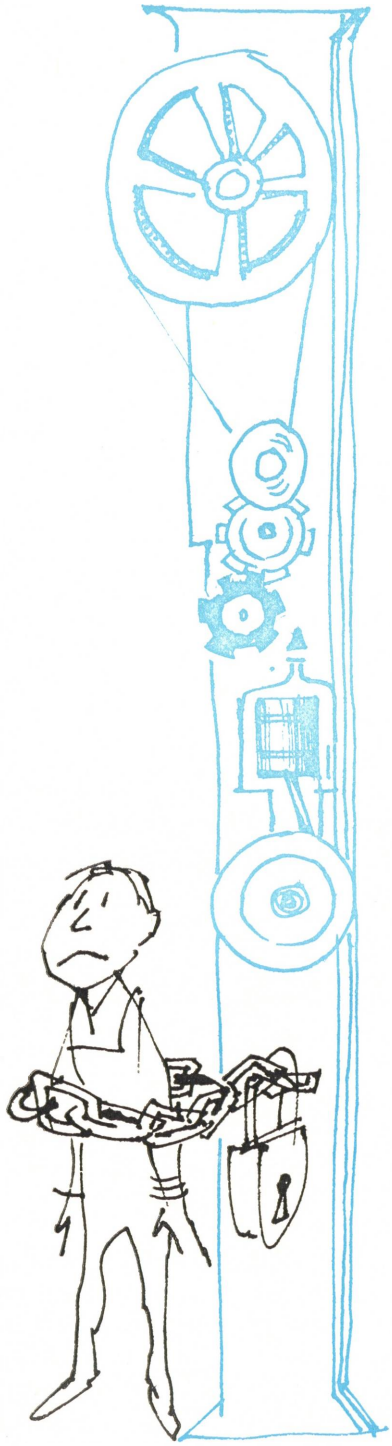
by James B. Bower and J. Bruce Sefert
University of Wisconsin

THE GROWING mechanization of data processing operations, particularly the automation brought about by the application of electronic computers, has intensified the human relations problems inherent in the design of business systems. As a result, business managers and systems analysts are devoting increased attention to the impact of the financial information system on the people within their organizations—and to that of the people on the financial information system.

Many trade unions, with some public support, have attacked automation as a leading cause of unemployment. There have even been proposals that automation and data processing revisions be banned altogether.[1] The relation of automation to unemployment remains unclear. Congressional hearings have provided a sounding board for automation's opponents and proponents but no satisfactory answer.

Management opinion is divided as to the actual effect on employee wage levels, job security, advancement, and morale of the many changes that are taking place in both factory and office as a result of changes in procedures, work simplification, elimination of man-

The research underlying this study has been financed in part by a grant from the General Electric Company to the University of Wisconsin. However, the conclusions, opinions, and other statements are those of the authors and are not necessarily those of General Electric Company or of any other group or individual.



Some studies have cited workers' fears of being chained to the machine.

tal data handling, and the advent of high-speed communication. These changes are not confined to companies installing computers but are magnified and highlighted there.

Since systems changes involve people, they do not always have the same effects. Sometimes they are or seem to be beneficial to one or a group of the people involved; sometimes, harmful. Some studies of the effects of wholesale revampings of data processing methods have indicated that the employees were on the whole happy with their new jobs, that they generally benefited through higher wages, and that no hardship of any significant duration was visited upon anyone.[2] Other studies have reported employee disillusionment with the new jobs, the elimination of many promotion opportunities formerly available, complaints of being "chained to the machine," empire building by a new elite of EDP specialists, stagnation of middle management, and other adverse effects.[3]

In any case it is clear that there is need for extensive planning of every major procedural or data processing change. Provision should be made in advance to combat any possible harmful effects of systems change on the employees concerned and to take account in the systems design of the effect of human factors upon the operation of an economical and efficient system.

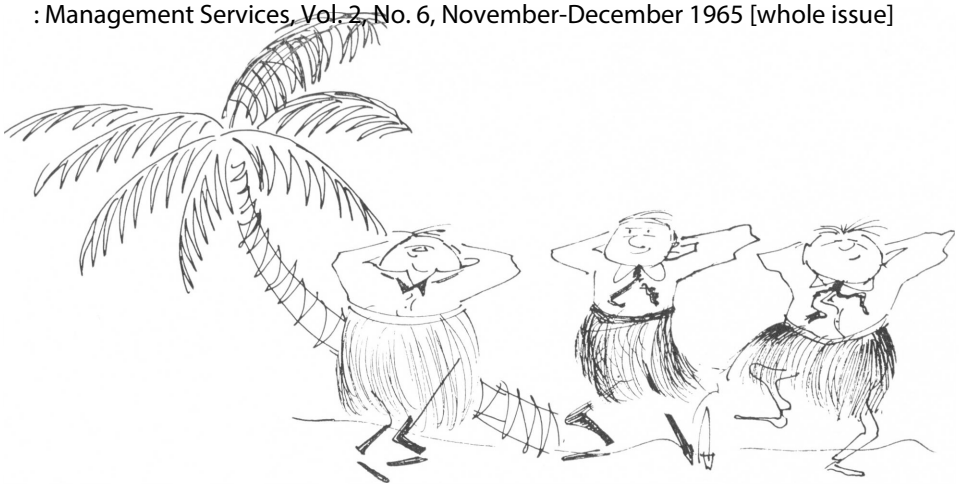
Human factors

The human factors principle of systems design, namely, that the design of a system should be consistent with applicable human factors since people are responsible for the effectiveness of the system, has been proved by experience to be a vital guide to the systems analyst in his work. The term human factors includes all those personality traits that consciously or unconsciously shape the actions and reactions of the people who must use the system as finally designed as well as those same traits reflected in the systems analyst himself as they may affect his ability to achieve an objectively efficient and successful design.

Only the more significant human traits can be explored here and those only as they affect systems design. Some factors, such as resistance to the new and strange, desire for job security, tendency to be influenced by the opinions of others, and preference for familiar work habits are basic in all employees at all levels but may apply with particular force or in particular ways with certain types of employees. Other factors become a problem only with certain groups.

For convenience in examining the effect of human factors on systems design, two levels of management are distinguished in this article. Top management consists of those executives who participate in companywide policy formulation, including the chief executive and those who report directly to him. The term middle management is used to encompass not only the usual group of middle and junior executives, such as division managers, department heads, and their staff functional advisers, but also operating supervisors and foremen since the human factors that affect this group as a whole are similar. Nonsupervisory employees are treated separately since their reactions to systems changes are usually different from those of people on the managerial levels. For purposes of this article the systems analyst is assumed to be either a member of a company's internal systems and procedures staff or an outside specialist in this field, who might represent an accounting or management consulting firm.

Some of the more important human factors that should be considered by the systems analyst in applying the human factors principle are illustrated in the exhibit on page 47. Unforeseen problems, including problems caused by human factors, often arise during



Some corporate patterns are as intricate as the rituals of a South Seas tribe.

the actual implementation of a new or revised financial information system, requiring adaptations. By taking as many human factors as possible into account during the planning of the system, however, the analyst improves his chances of producing an efficient, well accepted system with few subsequent revisions.

In the discussion that follows the components of the human factors principle are applied in detail to each of the three levels of personnel previously identified.

Top management

It is axiomatic that the wholehearted support of top management is required for systems acceptance and success. Middle management and nonsupervisory employees are quick to take their cue from the attitudes that flow downward. In the past, top management often viewed work procedures and systems study as a specialized function worthy of its attention only when a crisis arose. With the advent of computers, which are often so costly as to require justification to boards of directors or stockholders and which have been so heavily publicized as to become status symbols, top management has become much more involved in the problems of data processing.

This is fortunate, for continued top management attention is vital to the eventual success of any system. At several points during the systems project top management must review interim findings and approve or disapprove recommendations for further action. Careful consideration and prompt decisions are essential.

Mere interest and support from top management is not the whole answer, however. The analyst must take account of many human factors at this level in determining management's information needs, in alerting top executives to the full implications of any large-scale revision in the data processing system, and in making sure that executives are aware of and capable of obtaining the full range of benefits available.

Company patterns — Most established companies have certain patterns of activity that affect their approach to innovations. One systems analyst has likened these patterns to the rituals of a South Seas tribe, complete with dances to drive out evil spirits.[4]

In some organizations duties and responsibilities are well defined; many small, closely knit companies prefer a freer, looser structure.[5] Some managers are direct and forceful in ordering changes; others prefer devious and indirect methods. Some top managements are simply not prepared to make any substantial changes in the organization or in methods of operation. In such situations the systems analyst must decide whether to adapt the system to accommodate the attitude or to try to change the attitude.

The pattern of change in a company may have been molded by special factors that operated in the past. A top executive may feel that he holds his present position because of some procedure or method he introduced many years ago;

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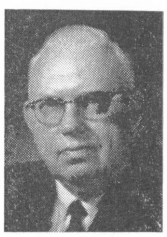

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The analyst should always handle "sacred cows" with extreme care.

he is not likely to welcome any change.[6] Special care should be taken to see that the new system, instead of endangering this executive's sense of value to the company, can be identified with his contribution as an outgrowth of it. Another top manager may have a pet project to which he gives special attention and which is part of his personal pattern of self-esteem. The analyst must always be alert to avoid colliding with such "sacred cows."[7]

Individual personalities are important, too. One executive may be a so-called detail man who likes to have a hand in designing procedures himself. Another may be an idea man interested only in the broader aspects of the system or a results man interested only in end objectives. In each case the analyst must adapt his approach accordingly.

If the company has a history of orderly and considered attention to continued improvement rather than one of patchwork solutions to immediate crises, the analyst can conclude that the top management is likely to be systems-oriented and ready to support him in designing and installing a new system.

Management climate — Companies that show sincere concern for the employee as a human being build up an employee trust in top management that is of great value in gaining acceptance of change. If management has been willing in the past to use employees' ideas, imagination, and suggestions and to pay attention to workers' feelings in visible ways, the systems analyst's task will be eased considerably.

He should, therefore, appraise the management climate of the organization as early as possible so that he can take it into account in systems planning. If he finds a climate of teamwork and understanding among departments, delegation of authority by management, and stimulation of the challenge of problem solving, he can devote his primary attention to technical problems. If he finds a climate of top management isolation, rigid departmental barriers, little or no downward communication, and a reluctance to keep employees informed of company plans and policies, he may need to educate top management about the importance of attention to people in assuring the success of any proposed new system.

An aspect of management climate that has particular significance for the systems analyst is the extent to which authority has been delegated to lower levels. If all decisions have traditionally been made from above, the analyst is likely to find managers and employees alike hesitant to make suggestions and express opinions; their ideas have dried up from lack of encouragement.[8] In such a situation top management needs to give visible evidence of its support of the systems project. It should, for example, select capable representatives from the departments that will be affected by the systems study to help the analyst with it, and it should give them the time and authority needed to do a proper job.

A detailed study of fundamental systems changes made over a five-year period in a large electric utility[9] provides a striking example of the way in which differences in prior participation in planning and problem solving can affect departments' contribution to and acceptance of change. In the accounting department much effort had been spent over the years in developing participation in management by intermediate and first-line supervisors. The result was a high degree of employee satisfaction, trust, and good will, which proved very valuable during the transition from one system to another. In the sales department, for a variety of reasons, the employees had never participated in management to this degree. Furthermore, this pattern continued during the systems changeover. Communication of information about the change was much less complete at all levels than in the accounting department. No attempt was made to present the new system to the sales employees in relation to their special interests and objectives. As a result, the sales employees never understood the system as well as the accounting employees, had less confidence in it, and presented more

difficult problems during the transition.

As recent experience with large-scale computer installations has demonstrated, employee acceptance of change depends heavily on top management's willingness to make assurances about job security, salary retention, opportunity for training, and rules to be followed in reassignment.[10] As the plans for a major systems change unfold, top management will have to chart its course of action in the field of human relations.

What attitude should it adopt toward displaced labor? Is it willing to assure to all affected employees the opportunity for continued employment regardless of the changes in data processing methods and departmental and individual functions? Is it willing to bear the expense of retraining employees? Will it show concern for the employees' self-respect and personal improvement during periods of change and at other times?[11]

Although these decisions are not the systems analyst's to make, he cannot — and should not — avoid some involvement in them. He has a responsibility to take account in his planning of any provision for utilization of present employees, their training and retraining, and their job mobility. He should, therefore, press for early top management decisions on these points.

In fact, the analyst's ability to obtain prompt policy decisions from top management on all questions that arise throughout the study will be an important factor in the success of his work. Procrastination in making difficult decisions is a basic human trait. The systems analyst must press firmly for such decisions while using every means available to demonstrate the logical basis of his proposals. In one manufacturing company the systems and procedures staff personnel were forced to spend 60 per cent of their time on attempts to obtain final decisions. In the words of one staff member, attempting to get a decision was "like trying to tie a rope around a pile of sand."[12]

Decisions will be particularly difficult to get if a basic change in organizational structure is required or if the proposed change will create an embarrassing personnel problem. If the organizational pattern of the company has tended to develop around personalities rather than being based upon logical division of functions, the difficulties of change will be magnified. If top management is adamant in refusing to make an indicated organizational or personnel change, the systems analyst may have to build around the existing structure or person, recognizing that a good system that has the support of management is to be preferred to the best system if the latter will not be supported or used.[13]

Desire for improvement — If the systems analyst finds that top management has a genuine desire to solve any systems problem discovered to exist, it is likely that he will also find the desire and courage to make the changes necessary to implement the solution.

Top management's willingness to assign good people to work with the analyst and to give them the necessary time and responsibility is one test of its real interest and concern. Too often the tendency has been to make such assignments on the basis of availability rather than suitability. If management shows such a tendency, the analyst needs to point out the importance of having outstanding people on

Sometimes getting a firm, final decision is like trying "to tie a rope around a pile of sand."

Top management should receive a realistic appraisal of the training time and costs of each system.

the planning group and the benefits to be expected.

The use of a project team made up of representatives of the various departments affected, operating with or under the analyst, may be a new problem solving procedure in the company. It has, however, many advantages. Not only does it usually produce a sounder systems design but it also greatly facilitates acceptance of the system, both by the members of the team and by others. The representatives of the personnel and industrial relations departments can help in determining the human relations climate of the organization and in helping to plan the final proposals regarding employee utilization. The representatives of the operating departments can be useful in alerting the analyst to any special human factors problems that may arise in their areas.

The strength of top management's desire for improvement will be further tested as it is informed of the training time and costs of installation that will probably be involved in any large-scale systems revision. A realistic appraisal of such factors during the planning phase of the systems project will give management an opportunity to determine its step-by-step involvement.

If cost cutting has been the principal factor in top management's motive for change, it may be desirable for the analyst to reorient management toward the goal of labor saving in the broadest sense, that is, the use of saved labor to make possible improved and faster information for decision making. A system that provides better tools for management is more valuable over the long run than one that simply reduces costs. This shift in emphasis toward a broader goal also will help to ease the fears of operating personnel about labor displacement.[14]

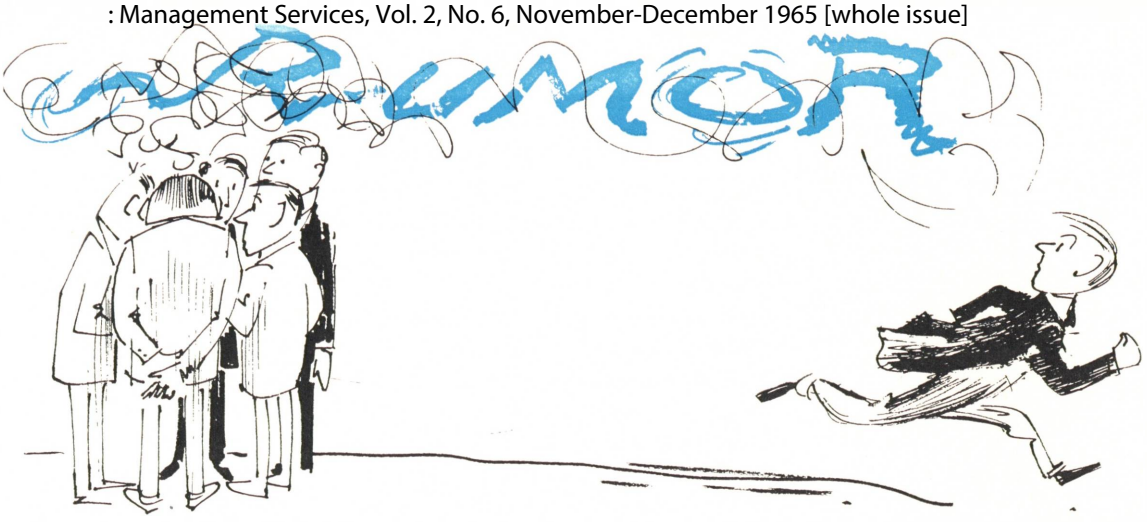
The systems analyst bears much of the responsibility for educating top management about systems in general and about his system in particular. He should do what he can to help management understand what the system can provide and how it can be of value in planning and decision making. At the same time he should be laying the groundwork for further systems advances. The managers of tomorrow must have a broad knowledge of the interdependence of all parts of the business and the potential for improving decision making offered by the increased variety of information made possible by a modern data system. The systems analyst can play a vital role in top management's data processing education.

Middle management

An understanding of the human factors at work in the middle management group of managers and supervisors is especially important to the systems analyst. The personnel at this level hold the key to success or failure of a new system. Top management relies on them for the organization's everyday efficiency and smooth operation; the nonsupervisory employees take their direction and set their course from them. The systems analyst has traditionally found it necessary to work closely with middle management. In systems analysis he must depend heavily on the information they furnish; in systems implementation and follow-up he needs their acceptance and cooperation.

Problems — Middle management presents a number of special problems for the systems analyst. Typ-

A typical problem is the middle manager so immersed in his own department that he can't see the significance of what's going on in the rest of the company.



In any organization it is difficult to get ahead of the rumor network. Thus management should always be frank and detailed about the scope of the study.

ically, managers below the top management group and supervisors have a narrow perspective on company operations. They are so immersed in their own jobs and their own departments that they cannot see the significance of what is going on elsewhere in the company. The systems analyst will have to devote considerable educational effort to the task of building up in the middle managers a feeling for the total job that is being attempted.

Typically, too, middle managers concentrate their attention on the technical rather than on the administrative and human relations aspects of their work. Thus, the analyst will need to keep emphasizing to them the importance of teaching the new system to the employees under them and the need for selling the system to the workers.

Another human factor that is important at the middle management level is the increased resistance to change that accompanies increased age. This resistance is likely to be especially intense in large and stable organizations. Age increases resistance to change partly because of growing reluctance to alter familiar and comfortable established work patterns and partly from the ever-present fear of inability to compete with younger people in the organization. This resistance is partly unconscious. There is an instinctive tendency to organize experience in a manner that will be minimally threatening and to believe what one wants to believe.[15]

Furthermore, middle managers are consciously fearful of automation. Any substantial reduction in the number of employees is likely to reduce the number of supervisors needed as well. Forecasts that the computer, by taking over routine decision making, will wipe out middle management have been highly publicized. Certainly the inflexibility of program necessary to ensure uniform input, processing, and output in a large-scale computer system changes the scope of middle management decision making. This may, as some claim, leave the manager free for higher activities, but some middle managers are understandably skeptical.

As with any other employee group, middle management's past experience with systems change is a powerful determinant of its current attitude. A manager whose last experience with a staff specialist was unfortunate may be convinced that all staff men are arrogant, impractical, and opinionated and that it is a waste of time to deal with them. Perhaps he once suggested an improvement that was not acknowledged or that was adopted without credit. If so, he is probably still nurturing his hurt feelings. The systems analyst will have to dig out such attitudes and convince the supervisor that suggestions will be welcomed and used.[16]

Past experience also, although unfortunately less frequently, can be a help. If earlier systems analysts have dealt with middle managers successfully—and particularly if top management has made a practice of encouraging middle management participation in problem solving and decision making—the systems analyst will find his path easier.

One advantageous characteristic of middle managers is that they are usually accustomed to working toward long-range goals, such as promotion, retirement, and education of their children. Thus, they do not need evidence that a change will bring them immediate benefits to the extent that lower-level employees do.

Preliminary study—Even before the study has actually begun, the systems analyst will need to be at work allaying the fears of middle management and employees alike. In any organization it is difficult to get ahead of the rumor network. As early as possible top management should make a definitive announcement of the scope of the

study. If this announcement can also contain assurances of job security and other measures for employment stabilization, so much the better. In case top management does not recognize the importance of informing employees early, the systems analyst should consider it his responsibility to point out the need for such announcements and recommend their timing and content. Reasons for the change should be stated, with emphasis upon the broader goals and the benefits to be derived by everyone. If possible, better use of labor rather than cost reduction should be stressed. Some companies planning computer installations have given employees as much as three years' notice of impending changes in order to accustom them to the idea.

Subsequent interim reports are also desirable. These should be as specific and factual as possible and should continue to stress positive benefits. Middle management in particular needs to be kept continuously informed so that it can answer questions from employees and interpret to them the aims and policies of top management.

The systems analyst can build the middle manager's confidence by treating him as an intelligent equal, competent to understand the system and its problems.

Analysis phase — The analysis phase of the study, when the systems analyst is gathering information on current procedures and work flows by interviewing middle managers and employees, gives the analyst one of his best opportunities to obtain supervisory cooperation and reduce supervisory fears.

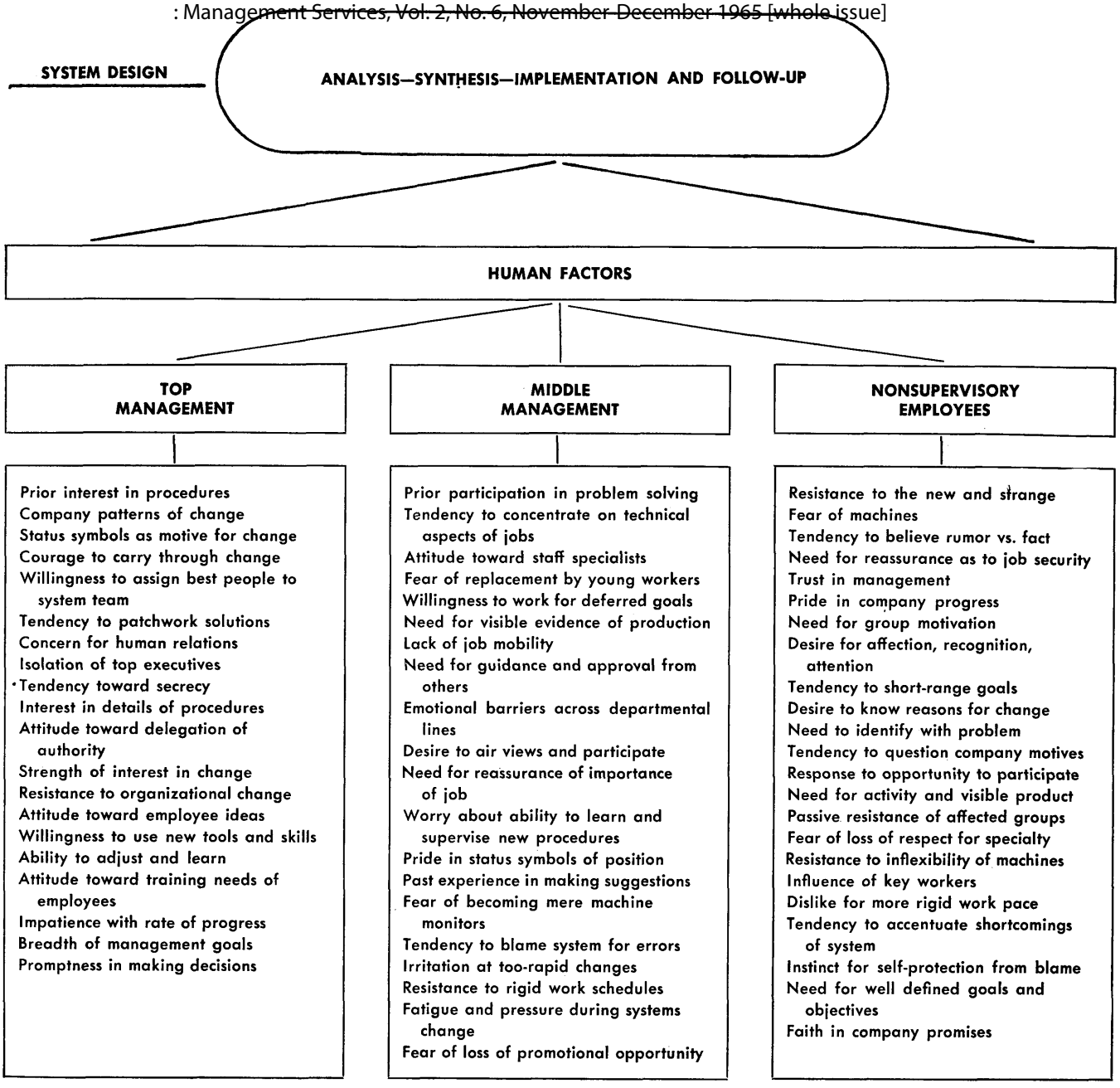
The middle manager's fear of loss of self-esteem and status can be countered by stressing the increased importance of each manager or supervisor through his part in supplying better information for decision making. The increased need for the manager as a trainer of personnel can be emphasized as an offset to any dimunition of his personal responsibility for decision making.

Middle managers will be anxious about possible decreases in employment and the effect on them. The systems analyst can reiterate any assurances previously given by top management as to job security, displacement policies, and retraining and can explain probable new positions and their duties. More generally, he can point out that studies of current employment trends indicate that the number of professional and technical workers will increase more than 40 per cent over the next decade and that the number in clerical and sales occupations will increase by 30 per cent.[17] He must be careful, however, not to promise upgrading to any specific manager.

Managers and supervisors may be worried about their ability to learn new techniques and keep ahead of their subordinates. Many will doubt their ability to supervise under the new methods. The systems analyst can cite the experience of other companies installing automated data processing systems to show that many persons over 45 have been trained to fill technical positions in the computer field, often more rapidly than younger persons could be trained. These companies have found that older employees' greater sense of responsibility, their reliability, their care for details, and their mature judgment have made such a policy advantageous.[18]

More generally, the systems analyst can build up the middle manager's confidence by treating him as an intelligent equal, competent to understand the system and its problems. The analyst should avoid all signs of condescension or any implication that there is the slightest question about the supervisor's ability to handle any situation that may arise.

In addition to allaying middle management's fears, the analyst should attempt to build positive support for the new system. If the supervisor is given an opportunity to air his views on the present system and take part in the planning for improvement, he will become interested in the ultimate success of the new procedures. The analyst should recognize the supervisor's experience and remember to be a good listener. Whenever appropriate, he should visibly record sug-



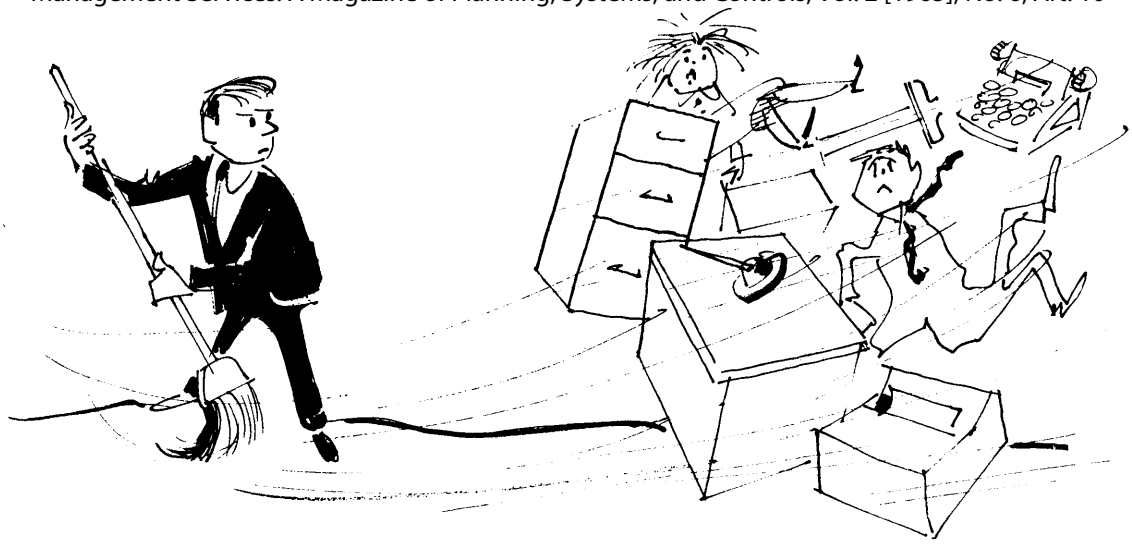
FOCUSING ON HUMAN FACTORS

gestions so that credit can be given for them if they are adopted.[19] And he should stress middle and top management's common interest in building the best possible system. Often it may be wise to interview the supervisor away from the office atmosphere to keep work pressures from interfering with his objective consideration of new ideas and to ensure that he will be free to discuss controversial aspects of the present and proposed systems.

The systems analyst's approach has been likened to that of a doctor whose objective is essentially preservative. He should adopt the view that the organization is basically sound and healthy and that he is not there to tinker for the sake of tinkering. In this way he will impress the supervisor with his concern for people and their problems and his willingness to conserve ideas that have survival value.

Implementation — Other problems arise during implementation of the system. When possible, the analyst should anticipate these problems and do what he can in the planning stage to minimize or offset them.

One source of job dissatisfaction for workers and supervisors alike after the installation of automated systems is the lack of visible evidence of the product of their labor. Workers have a basic need to see that their jobs are significant. A series of entries, a list prepared, a



Some analysts give the impression of automatically opposing any methods in use before their arrival.

report are all visible evidence of accomplishment. Closely related is the feeling that to be producing one must be doing. In many new systems supervisors and workers see no end product of their work, nor is the work itself highly visible. This trend is likely to continue.

The only solution for the systems analyst is to begin educating middle management to other job satisfactions as early in the systems project as possible. This will not be easy since these other satisfactions tend to be more abstract than the old. The analyst also should remind supervisors that they will have to plan to give more attention to worker morale and develop new methods of praise and reward. Most middle managers will need training in human relations, and the analyst should make certain that such training is provided.

The relatively greater inflexibility of highly integrated data processing systems will create problems for middle management. Because of the interdependence of parts of the system, the supervisor will be blamed for delays further down the line. He will be subject to greater pressure for adherence to higher work standards, and he will find that improved feedback will pinpoint responsibility more surely than before.[20] If he is caught off guard by these changes, he may become resentful and resistant—and transmit this feeling to his subordinates. The systems analyst can forestall these reactions by holding briefing sessions with both supervisors and employees and by meeting regularly with individual supervisors during and after the system implementation to check on their reactions and on the morale of their employees.

Unreasonable deadlines can provoke resentment in both supervisors and employees. The analyst should work with top management to keep deadlines realistic. If it becomes evident that the deadlines set cannot be met through no fault of the supervisors or employees, he should relieve their anxiety by assuring them that no blame attaches to them.

During the entire systems design period middle management's work load will be increased. Learning new procedures, training employees, being interviewed, attending meetings, and supervising two parallel work processing systems during testing periods can combine to create tremendous pressure on middle management, pressures that are not conducive to a kindly feeling toward any new system. By careful preplanning the analyst should attempt to minimize these pressures so far as is possible.

It is just as important for the systems analyst to enlist the understanding and support of the rank-and-file employees as of the managers. A group of nonsupervisory workers can sabotage a system they do not accept just as effectively as a supervisor can. In fact, their sabotage may be even more difficult to combat since it may be more subtly applied through group action.

Although the basic human factors that affect the nonsupervisory employee are the same as those that operate at the top and middle management levels, his different position in the organization and normal lack of contact with top management plans and policies lends added weight to some of them. For example, because nonsupervisory workers, particularly younger ones, tend to have shorter-range goals than management, it is difficult to sell them change based upon some abstract general benefit. They demand an immediate personal advantage.

The nonsupervisory employee is generally more group-oriented and less of an individualist than the manager. He is more susceptible to rumors and to the influence of his fellow-workers' opinions. Other human factors that are particularly important at the nonsupervisory level include the desire to produce a visible product as evidence of

work accomplished; a need for recognition, affection, and attention; the importance of status in the eyes of co-workers, friends, and family; a need for activity in work as contrasted with the relative inactivity of merely monitoring a machine; the need to lean on others for support and encouragement; and the social need for working in groups. Automation is making the worker more isolated at his work place at the same time that there seems to be a growing number of other-directed persons in our culture who look to others for guidelines and approval.

The basic instinct of resistance to the new, strange, and unknown is intensified in employees by the common human fear of machinery as a displacer of labor. Recurrent periods of unemployment help to keep this fear alive. Automation seems to have replaced the loom and steam engine of the early Industrial Revolution as the public and trade union symbol of danger from impersonal forces outside the worker's control.

The systems analyst cannot completely prevent the operation of these basic human factors. It will take a long time to substitute new values and new job satisfactions. If, however, he is aware of these forces at work, he may be able to offset them or at least minimize their effects by proper training and by introducing contrary forces.

Even the employee who would admit the desirability of proposed systems changes if he were capable of being objective is likely to develop a core of passive resistance under the influence of his fears and his fellow-workers. The systems analyst must exert continuous positive pressure to overcome this tendency.[21]

The importance of keeping the employees informed has already been stressed. The inevitability of rumors negates the theory that information which might upset the employees should be withheld. They will be upset anyway, and they need reassurance as to their job security, opportunities under the new system, and steps to be followed during the changeover. In addition to the usual meetings, bulletins, and newsletters, the union may sometimes be used as an effective channel of communication.

Many of the employees the analyst interviews will question the real motives of the company in making the changes. The analyst can break down this skepticism by relating the company's general systems problems to each individual's own work experience, thus demonstrating the need for improvement. Often it is wise to devote extra effort to convincing the opinion leaders within employee groups so that they in turn can become salesmen to their fellow-employees. Such employees should be given opportunities to air their views, and the analyst should return to them for further suggestions as the project develops. The analyst must be careful to sell the ideas on their own merit rather than by mere personality; there should, of course, be no misrepresentation.

To counteract employee fear of loss of status, the analyst can emphasize the new job values, which will place a premium on responsibility. He can encourage employees to apply for new positions as they open up. By showing genuine interest in the individuals he is interviewing, the analyst can do much to boost employee morale and build confidence.

As with middle managers, nonsupervisory employees should be prepared for the greater rigidity of mechanical equipment and the importance of interdepartmental teamwork in keeping the work flowing. The analyst should emphasize the importance of adherence to work standards, both to keep the employee on his toes and to keep him from blaming breakdowns on "the system" rather than on human errors. Any tendency to blame the system for errors can create serious operating problems by undermining confidence in the system and thus encouraging the human tendency to create addi-

Even the employee who would admit the desirability of system change if he were capable of being objective is likely to resist it under the influence of his fears and his fellow-workers.

tional records as protection against possible blame for error. The plan for system implementation should include provision for continuous checking by the analyst to uncover possible sources of breakdown and eliminate trouble spots promptly.

Another systems design technique that is helpful in preventing breakdowns is to build some flexibility for limited self-adjustment into the system. Allowing affected departments to adjust for unforeseen contingencies without having to wait for a formal systems change prevents irritants from growing and gives both employees and supervisors a sense of identification with the system.

The analyst himself

As a human being, the systems analyst is, of course, subject to some of the same human factors that operate in managers and employees—and to some of his own. When given an opportunity to comment, employees have variously accused systems men of demonstrating a narrow perspective, of having a tendency toward isolation, of talking in language incomprehensible to the ordinary person, of cutting across lines of authority, of empire building, and of stirring up jurisdictional disputes. Some analysts have given the impression of automatically opposing any methods in use before they arrived on the scene, setting themselves almost by instinct against the old to favor the new.

The advent of electronic data processing and the necessity of combining on management and operating teams persons of technical training and scientific background with those having only operating experience have compounded the problems of human relations in the systems field. Often the specialized personnel are accused by the others of setting themselves apart from the regular organization, of adopting a tough attitude, and of seeming to feel that human frailties are a nuisance best avoided by adding equipment.

The natural suspicion that an expert arouses when he comes into a department to begin an analysis of work flows and procedures makes it all the more important for him to establish cooperative relationships as quickly as possible. Among the more desirable qualities in a systems analyst are humility, a realization that his mission is one of service, not an end in itself, and a genuine interest in people. He should be a good listener, willing to accept suggestions, analyze them objectively, and give due credit for any ideas adopted. Giving credit for an idea to the person whose acceptance of it is sought can have a strong influence on the employee's interpretation of a situation.[22]

The systems analyst's awareness of the problems that human factors can cause for him in his work makes it all the more important for him to analyze his own methods critically to see whether any of the difficulties he may be encountering in obtaining cooperation and acceptance from employees may stem from his own failure to practice good human relations. Like Caesar's wife, he should be above approach.

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Economists nearly always adjust their data to allow for seasonal influences; accountants almost never do. This author suggests that adjusted figures might have some advantages for internal reporting.

SEASONAL ADJUSTMENT OF ACCOUNTING DATA

by Werner Frank
University of Wisconsin

To keep trends from being distorted by regular and predictable seasonal influences, economists often use seasonally adjusted figures in their analyses of aggregate economic data. The usefulness of such adjustments has been so widely accepted that the raw (i.e., unadjusted) data for many economic series published by Federal agencies are not even made available; the only data published are the seasonally adjusted values.

Despite the widespread use of seasonally adjusted aggregate economic data, however, there has been comparatively little corresponding acceptance of the applicability and use of seasonal adjustment techniques by individual companies in processing and evaluating their own accounting data. The purpose of this article is to suggest ways in which accountants might apply these techniques to accounting data in order to develop additional information that management would find helpful for planning and control. While it is also possible that certain seasonally adjusted accounting data would provide useful information to groups outside the company, this article is not concerned with the possible use of such adjusted data in reporting to the public.

Most seasonal adjustment techniques are based on the idea that if there are certain factors whose impact varies systematically from period to period within the year, the effect of those factors can be isolated through an analysis of historical data. Such an analysis will usually provide measures of the magnitude of this impact for each month or season of the year. These measures are termed seasonal factors.

In the analysis of a series of monthly historical data, it is often useful to divide the actual values of this series by the seasonal factors for the series in

The author wishes to acknowledge the helpful comments and suggestions made by members of a faculty research seminar at the University of Wisconsin and to thank J. Dimling and G. Toler of Marathon Oil Company, who developed much of the analysis illustrated in Exhibits 1 and 2 as part of a paper submitted for a graduate seminar at Bowling Green State University.

order to obtain monthly values free from seasonal effects. This series of adjusted monthly values may then be examined to determine the influence of other factors. Or, if a monthly figure is obtained that is expected to be representative of the average level of some item over a long period of time in the future, that monthly figure may be multiplied by the same set of individual seasonal factors to estimate the specific values for each individual future month.

Notice, however, that these techniques do not generally spell out the causes of the seasonal effects; they only measure them. The effects might be due either to natural causes that vary from season to season (such as changes in temperature, rainfall, etc.) or to social factors, including the seasonal patterns that have developed in our society because of such influences as the dates of vacations and holidays in different times of year.

It is not the purpose of this article to evaluate the theory or the mechanics of the various methods for accomplishing seasonal adjustments. Most of the widely used methods, however, consist essentially of the determination of typical values of seasonal factors for each subperiod (i.e., week, month, or quarter within the year) by calculation of a ratio which relates the actual values for that subperiod to an average for a surrounding longer period of time.

Relatively sophisticated computer programs are available for this purpose which utilize successive smoothing of ratios, incorporating weighted moving averages of varying lengths. Some of the illustrations contained in this article are based on one such program in the IBM 1401 Users' Group Library, but similar programs are generally available for most computers and are identified as being based on Census Method II or the Shiskin-Eisenpress Method. Other seasonal adjustment methods have been developed utilizing regression techniques and analyses based on the cyclical properties of trigonometric functions, but these have not yet received widespread acceptance.

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Usefulness for planning

In any situation there are certain variables or factors outside the effective control of business management, while others are amenable to substantial modification by management's actions. In accounting, this is usually the distinction that is made between noncontrollable and controllable factors. Seasonal factors are generally associated with the first group since, if management could manipulate the factors giving rise to seasonality, there would be no reason to expect any regular pattern, nor would there be any need to work with historical data to uncover patterns that are expected to recur in the future. Management's intentions would give this information directly.

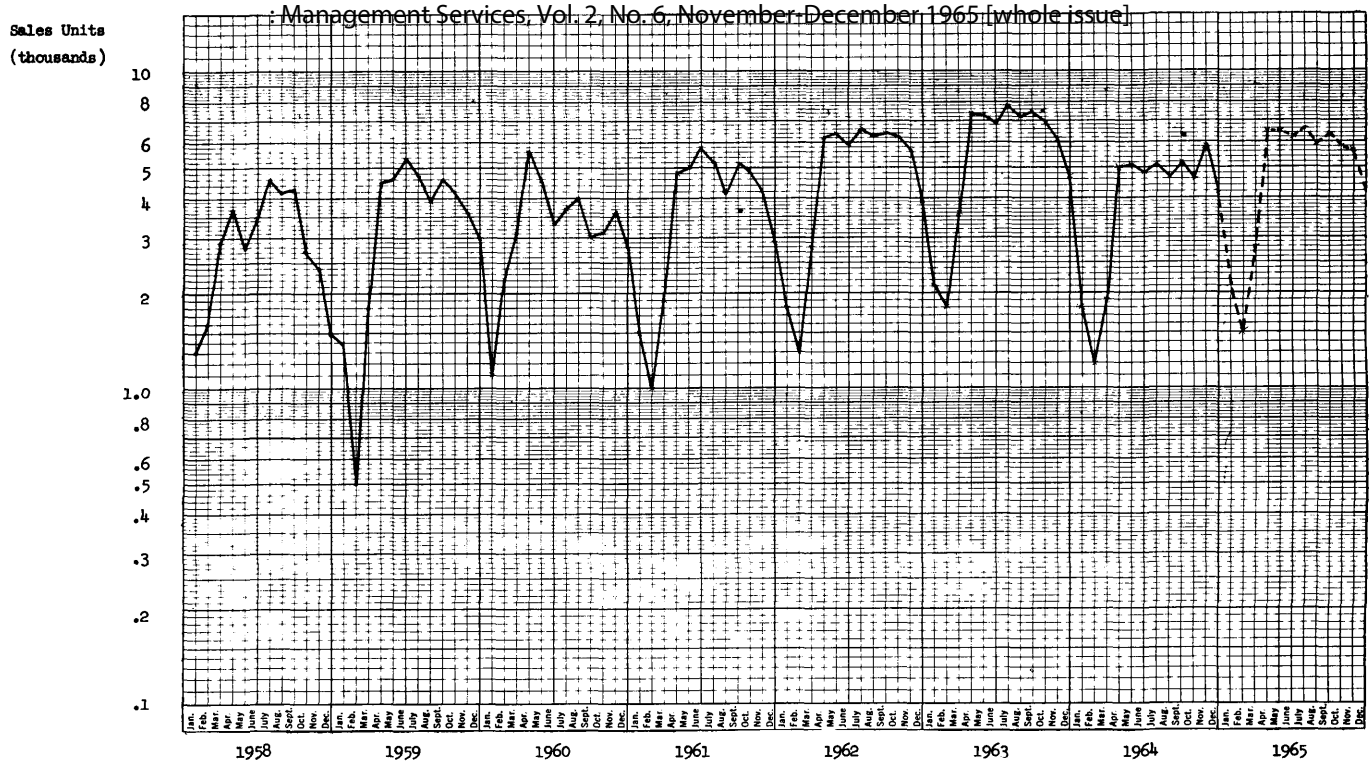
Regularities may exist in noncontrollable factors that stem from nature (e.g., weather), the characteristics of assets in use in the business, the institutional framework in which the firm operates, or dealings with groups that have substantial independence of action. Such groups would include customers, creditors, suppliers, the government, and, to a lesser extent, employees. Projections of the impact of these groups on the company may be difficult since by definition the company has only limited control over them. If there is reason to believe that there is a seasonal pattern in their behavior, however, this fact can be used to increase the accuracy of the projections of their short-run behavior. In the accounting system such short-run projections or forecasts may be formally incorporated into the firm's budgets or profit plans.

The usefulness of applying seasonal factors to data to be used for these purposes depends partly on the degree of independence of action of the group or process whose activities the data reflect and partly on the elaborateness of the budgeting and planning procedure. To the extent that management can exercise control over the outside group or process, the budget becomes less a prediction of external events and more management's declaration of intent. The statement, "Our budget is what we intend to *make* happen," implies that the activities reflected in the budget are subject to management control. In practice, of course, activities are usually neither completely controllable nor completely beyond management's influence; the applicability of seasonal adjustment is similarly subject to a range of utility. Before using a seasonal adjustment technique, the accountant should decide whether the particular set of data in question is subject to such a degree of control that seasonal adjustment of the data would add little to the analysis.

However, even in circumstances where the budget or plan is intended to represent the results that management expects to achieve rather than a forecast of events largely outside management's control, a useful first step would be to extrapolate historical trends into the future. Such an extrapolation could then serve as a basis for viewing the situation as it would develop if management's actions were unchanged.

For some companies, the budgeting process is not a formal procedure resulting in explicit budget projections and regular comparisons of actual and budget figures. In these companies a projection of past trends may be useful as a bench mark in the evaluation of current performance.

In the budgeting procedure, it is



COMPANY A SALES UNITS

EXHIBIT I

possible either to build up an annual total from quarterly or monthly estimates or to reverse the procedure, making the initial budget projections in terms of the year and then breaking down the annual totals into individual quarterly or monthly figures. If the latter procedure is adopted, specific seasonal factors are needed for each quarter or month. If the former practice is used, seasonal factors will give an indication of the pattern that has existed in the past, and hence can be used as the background against which future projections are made. Most seasonal adjustment techniques provide such specific seasonal factors.

Example: As an example of the way in which available techniques for seasonal adjustment may be used in planning, consider the case of Company A, whose products are subject to marked seasonal variations in demand. This company's physical sales volume of a particular product line for the past seven years is shown in Exhibit 1 on this page as a solid line.[1] An analysis[2] of the seasonality present in these data for the past seven years provides estimates of the monthly seasonality expected in 1965. These estimates are shown in the second column of Exhibit 2 on page 54.

The factor for January, 41.3, is a measure of the extent to which January sales are below the average for the year. If it is estimated by other means that sales of this product during the year 1965 will be 60,000 units, and if the price in effect will be $10 per unit, the total sales revenue for 1965 will be $600,000. This averages $50,000 per month ($600,000 divided by 12 months). The estimate for January sales, taking into account the seasonal factor, would be found by multiplying the average monthly sales of $50,000 by the seasonal factor for January shown in Column 2, 41.3%. This gives a seasonally adjusted estimate for January of $20,650.

By similarly multiplying the $50,000 average monthly sales figure by the other monthly seasonal factors, figures for the other eleven months may be obtained. These amounts are shown in the third column of Exhibit 2 and the projected physical volumes corresponding to these dollar sales volumes have also been plotted in Exhibit 1 as a broken line.

Initial estimates for monthly budgets or profit plans might be obtained in this way and then modified by sales personnel in the light of specific conditions that they believe will alter the past pattern of sales. If it is not considered feasible to devote much individual attention to the development of monthly values for numerous individual items, monthly values obtained by the procedure previously described might be used directly without further refinements based on judgments and evaluations of sales and operating personnel.

Usefulness for control

Another phase of the management process in which seasonal adjustment may prove helpful is

SEASONAL FACTORS AND PROJECTED COMPANY A SALES

Month	Seasonal Factor	Projected 1965 Sales
January	41.3%	$20,650
February	29.4	14,700
March	56.6	28,300
April	129.1	64,550
May	129.8	64,900
June	124.8	62,400
July	131.1	65,550
August	117.4	58,700
September	127.4	63,700
October	116.6	58,300
November	114.2	57,100
December	82.3	41,150
Total Annual Sales		$600,000

EXHIBIT 2

the review of the results of action. This evaluation of performance involves the use of accounting information for purposes of control. In any evaluation, the actual performance must be compared with some bench mark to judge its adequacy. A number of bench marks have been developed in accounting, including the budget for the period, the standards for the work accomplished, a profit plan for the period, the actual levels of performance in the same period last year, the performance in the previous period, and the performance of related groups (e.g., other departments, divisions, companies, the industry, etc.) in the same period.

If desired levels of performance have been stated in terms of predetermined goals involving bench marks such as budgets or standards, then performance should be evaluated by reference to these bench marks. Any seasonal influences, if appropriate, should already have been taken into account in the determination of the bench mark levels, making seasonal adjustments of actual data unnecessary.

Many companies, however, have not yet developed formal budgeting or standard cost procedures. Such companies usually rely heavily on historical comparisons with past periods' results in evaluating performance. Even companies that have budgets and standards may still wish to make additional comparisons with historical data, since such comparisons provide an added dimension to the evaluation of performance.

In making a comparison utilizing past periods' data, the common practice is to compare the current month's data to the data for the corresponding period in the previous year. A disadvantage of such comparisons is that they ignore the intervening experience. In a dynamic situation there may be enough significant changes in the space of a year that the experience of twelve months ago may not provide a meaningful basis for comparison. To establish the existence of trends, the current year-to-date total may be compared to the year-to-date total in the previous year. Such totals, however, also incorporate a year's time lag. To provide a more current bench mark, data of the previous month might be used, and, as an indication of trends, a series of recent months' data might be employed.

The major drawbacks to the use of the most recent months as a basis of comparison are, first, that the calendar months are of unequal lengths, and, second, that in many situations certain months are known to be usually "better" or "worse" than others. While the first difficulty can be eliminated by the use of an adjustment for varying working days to reduce all periods to a uniform length,[3] the latter problem can best be handled through the use of seasonal adjustment.[4] If a series of monthly data is adjusted to eliminate, so far as possible, the effects of varying lengths and seasonality, then useful information can be gained by comparing the performance of the current month with that of the last month, and by examining the trend of performance as exhibited by the pattern shown in the most recent months.

Example: For a variety of reasons, certain indirect labor costs of the B Company tend to fluctuate seasonally. Since the firm does not have a standard cost or budgeting system, comparisons are made on the basis of prior months' costs. For Plant 1, labor cost comparisons for May, 1965, are shown in Part A of Exhibit 3 (at left).[5]

EXHIBIT 3

LABOR COSTS FOR PLANT 1
MAY, 1965

A. Comparison of unadjusted actual costs

	May, 1965	Last Month	This Month, Last Year
Actual labor cost for the month	$209.5	$195.6	$189.2
	Year to date through May, 1965	Year to date through May, 1964	
Actual labor costs	$940.1	$854.5	
May labor cost as a per cent of the year-to-date total	22.3%	22.1%	

B. Comparison of seasonally adjusted costs

	May, 1965	Last Month
Actual labor costs incurred	$209.5	$195.6
Seasonal factors	11.4%	10.4%
Seasonally adjusted labor costs	$187.3	$188.1

Based on the comparisons of actual costs incurred, the figures shown seem to indicate a deterioration of the labor cost picture for May, 1965. More dollars were incurred in May than in the previous month or in the May of the previous year, and the period January through May accounted for more of the cumulative labor costs in 1965 than in the preceding year.

While the comparison with 1964 is of some use in evaluating the long-term progress of the firm, it is much less appropriate for measuring short-run, month-to-month progress. Comparisons with the previous month, April, must be qualified because of such factors as different numbers of working days in the two months, differences in the level of activity in the two months, etc. To the extent that the factors influencing costs tend to conform to stable seasonal patterns, however, the actual labor costs incurred in April and May may be deflated by seasonal factors determined on the basis of the past periods' seasonal pattern.[6] This adjustment will reduce the actual costs incurred in April and May to the level of the "average" or "typical" month. The labor costs after adjustment indicate that May's labor costs were, in fact, relatively lower than in April, based on the changes in labor cost levels that were typical over the past eight years. This is illustrated in Part B of Exhibit 3.

A necessary caution concerning the use of seasonally adjusted cost data should be inserted at this point. Seasonally adjusted cost data should not be looked on as a substitute for standard cost and budgetary data in the evaluation and control of costs. When available, these tools should form the primary basis for the evaluation of the current month's costs. There are situations, however, where these procedures are not in use and where management still must rely on historical cost comparisons. In these instances, where stable seasonal patterns in cost exist, seasonally adjusted cost data can be useful.

Before relying on seasonally adjusted data, the accountant should make sure that there is no reason to expect substantial changes in the past patterns of seasonality. Any large sudden movement in the pattern of cost incurrence, e.g., the reorganization of a production process, will make a comparison based on past patterns invalid. Moreover, if the importance of seasonality in the past is relatively small compared to other factors, any analysis based primarily on the seasonality present in data would not be at all appropriate.[7]

After examining the effect of seasonally adjusting accounting data and considering the uses made of accounting data, it is suggested that the seasonal adjustment of accounting data would be helpful in the areas of planning and forecasting and in the area of performance evaluation. As an aid in planning, the knowledge of the extent of seasonal fluctuations can be used to establish plans or forecasts on a monthly or quarterly basis which will more adequately reflect the patterns of seasonality present. In the area of control, actual performance for the current period may be measured in comparison with performance in the most recent periods to help answer the question, "How well are we doing compared to last month?"

As with the use of all statistical techniques, the application of seasonal adjustment techniques cannot be an indiscriminate and mechanical process. The decision as to what types of accounting data to adjust and the selection of the techniques to be used require judgment. The analyst must take into account the regularity and extent of the seasonal patterns, the characteristics of the adjustment techniques, and the uses for which the adjusted data are intended.

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[1] These data are adapted from Exhibit 1 of Case 11-5 in Richard Smith, *Management Through Accounting*, Prentice-Hall, Inc., Englewood Cliffs, N.J., 1962, p. 321.

[2] This and the subsequent analysis in Exhibit 3 were made using the Census Method II (Version X-9) method of seasonal adjustment, utilizing a standard IBM 1401 computer program.

[3] The use of 13-period, 4-week years provides periods of comparable length but has the drawback that the periods do not correspond to calendar months, making external comparisons difficult.

[4] Insofar as the disparity between the number of working days in a given month of the year does not vary appreciably over a period of years, seasonal adjustment techniques will tend to adjust for this factor along with the composite of all other factors whose influence varies in a systematic way within the year. A more precise procedure would be to make a preliminary adjustment of the data for the varying number of working days in each period prior to subjecting the data to seasonal adjustment. A related adjustment for intra-month day-of-the-week variation (to take account of the different number of Sundays, Mondays, etc., that a given month may have from year to year) may be important for companies in which the daily pattern is significant. Such adjustments are discussed in the O.E.E.C. Research Paper No. 4, "The Measurement of Calendar Variation," by Stephen N. Morris in *Seasonal Adjustment on Electronic Computers*, Organization for Economic Cooperation and Development, Paris, pp. 345-359.

[5] The labor cost used in this illustration represents an actual situation in a medium-sized Midwestern manufacturing firm.

[6] The seasonal factors shown in Part B of Exhibit 3 were obtained from an analysis of eight years of labor costs of Plant 1 using the Census II (Version X-9) method.

[7] While traditional statistical tests of significance are difficult to incorporate in most techniques for seasonal adjustment, an indication of the importance of the seasonal component of a series may be obtained by examining the ratio of the average monthly seasonal component to the original series. For the sales of A Company shown in Exhibit 1, this ratio is 80%, indicating that seasonality was a very significant component of the series.

what people are writing about

BOOKS

Work Measurement and Cost Control by C. F. GRAHAM, Pergamon Press, Oxford, 1965, 213 pages, 17s, 6d.

In this little volume, designed for the accountant and general manager as well as for the work study trainee, the author attempts to explain what the practicing executive should know about work measurement in order to use it effectively in cost control.

The successful combination of work measurement and cost control does not happen simply by chance, Mr. Graham emphasizes. The work measurement system must be designed in such a way that it is readily usable in controlling costs. Mr. Graham, who is head of work study training for the Reed Paper Group in Great Britain, seeks to explain how to do this.

The typical work measurement textbook, Mr. Graham complains, simply teaches a routine for taking a simple study, a routine that is seldom really applicable in practice because so few actual cases fit the simple case. In an effort to produce a more practical guide, Mr. Graham concentrates on the basic concepts of work measurement so that the practitioner can "bend the techniques to suit the reality" rather than vice versa.

After warning the reader against a group of "historically based misconceptions" in the field, Mr. Graham explains work measurement for "the simple case," one operative working alone on a task that is controlled only by his own efforts, and then goes on to discuss group work, man-machine interaction, multimachine operation, and the effect of consecutive jobs with overlapping basic time distributions (recommending a method of solution by simulating the reality in a numerical model).

Then he goes on to apply work

measurement in cost control, covering labor cost standards, basic control information, and control calculations. He concludes with a case study, building out of work measurement a system that will show management total standard and actual wages, with an explanation of variances; standard and actual unit costs; group and individual efficiencies; historical job costs; and production time data.

Although many details of the time study process are omitted, Mr. Graham has packed a good deal of information into a small space. The result should be particularly useful to the cost accountant who needs to understand but not conduct time studies.

Accounting for Management by ERIC L. KOHLER, Prentice-Hall, Inc., Englewood Cliffs, New Jersey, 1965, 275 pages, $7.95.

Accounting for nonfinancial executives has become a popular topic for management training seminars. This concise explanation of accounting terminology and methodology would make the ideal text for such a course.

The object of this book, according to the author, is to set forth the principal features of accounting with which management ought to have more than a passing acquaintance. The book is also offered to investors and others who want a better understanding of financial statements and reports and to beginning students of management accounting. But its primary audience is executives of any level who must deal with and be dependent on accounting and accountants.

This approach is partly responsible for the book's compactness. By assuming that the reader has no knowledge of accounting but is familiar with everyday business practices, the author is able to omit what he claims constitutes 75 per cent of the subject matter of the average accounting text, namely, descriptions of business practice.

Thanks to this concentration of subject matter and to a simple, clear, concise writing style, Mr. Kohler packs a lot of information into 275 pages. As might be expected from the author of the well known *Dictionary for Accountants*, he is meticulous about defining terms; indeed, the early chapters consist almost entirely of definitions.

After explaining the fundamentals of account keeping, Mr. Kohler discusses such basic elements of financial reporting as the balance sheet, stockholders' equity, the income statement, consolidated statements, flow statements, and the audit function. Only three chapters are devoted to management accounting; they cover costs and their controls, management and internal control, and budgeting, but they provide as good a short discussion of these topics as can be found anywhere.

Every accountant would find his life much easier if all his business colleagues and/or clients mastered this book.

International Handbook of Management edited by DR. KARL E. ETTINGER, McGraw-Hill Book Company, New York, 1965, 642 pages, $19.75.

This encyclopedic volume covers a wide variety of problems involved in doing business outside the United States, particularly in less developed countries.

Sixty-three American and foreign authors have contributed articles to this anthology. Their topics range from the most general and theoretical — e.g., division of labor — to the most specialized and practical — e.g., crop sprinkling in tropical Africa.

The articles are grouped into six sections: management principles and techniques, international corporate activities, problems in financing, special development problems, rural management problems, and training of managers. As with all such collections, the chapters vary in quality and in emphasis. Their selection and organization seem to have been dictated more by availability and expediency than by any overall plan.

It is probably misleading to call this book a handbook, for as a whole it does not seem to be aimed at any specific audience. Some chapters — hiring employees for foreign assignments, establishing a manufacturing business in Brazil, insurance for international operations — seem to be intended for American companies operating overseas. Others — including a group of articles on the basic subjects that appear in any management handbook — seem to be written for people in the less developed countries themselves. The ideal reader is probably a Ford Foundation economic development consultant.

All this is not meant to imply that the book is useless. Many of the contributions on specialized topics are fascinating, for example, a report on the use of psychological testing in Latin America, and many would be highly useful to those who are for some reason concerned with such problems as how to market pesticides overseas or how to develop subsoil resources in the Ivory Coast. The businessman would be wise to check the table of contents to see whether his own interests are represented before ordering this book.

MAGAZINES

Perspective: Some Possible Pitfalls in the Design and Use of PERT Networking by LAWRENCE S. HILL, *Academy of Management Journal*, June, 1965.

PERT networking is still too new a technique to have had all the potential problems solved. This article points out some of the difficulties that can arise in actual practice.

PERT, PERT/Cost, CPM, and their variants unquestionably represent a real breakthrough in the control of complex projects, and

many companies have used them successfully. Success is not automatic, however. The catch, as with many other techniques, is that people are still involved, and people are not perfect.

In this brief article the author, a member of the cost analysis department of The RAND Corporation calls attention to some of the problems that can arise in the actual application of PERT networking. Most of them stem from inadequate communications, often compounded by deficiencies in network design.

Published manuals on networking techniques, the author concludes, represent the "normative approach to systems design. However, individuals in implementation of new systems have a habit of straying from well considered intentions. Human habits being what they are, moreover, there is a general inertia toward any change."

Systems designers, he warns, must take these human factors into consideration in planning and operating the network. Furthermore, he cautions, no single systems design can be expected to anticipate all possible contingencies. Thus, there is no substitute for sound and logical judgment in the design of networks and in their subsequent analysis.

Replacement Policy by R. R. NEILD, *National Institute Economic Review,* November, 1964.

This study reports the results of a questionnaire completed by British companies, mainly in the engineering industry, focusing on the question of replacement policies.

It is difficult to distinguish between a replacement and a new investment. In a narrow sense, replacement would imply that a new machine yields the same product and has the same capacity as the old machine. Practically, this is impossible. Nonetheless, companies distinguish between these two types of investment and account for them separately. This fact makes the replacement problem of some importance to investigate, since the way in which it is handled has an important influence on the growth of the economy in any industrial nation.

The major techniques actually used in analyzing replacements as well as new investments are the pay-off period (P.O.P.), the flat (undiscounted) rate of return (R.O.R.), the discounted cash flow (D.C.F.), and the MAPI System. Whatever technique is used, the investor seeks to determine whether the cost advantages from operations are sufficient to assure the recovery of the outlay (depreciation) and a minimum rate of return (profit including interest) over the estimated life of the asset.

A questionnaire was sent to 301 British companies participating in a conference run by the Production Engineering Research Association; 133 replies (44 per cent) were received, mainly from large companies. The object was to "find what procedures are typically used by firms. How far do they make calculations rather than rely on judgment? What investment criteria do they use? Do they take account of taxation and tax allowances. What minimum return do they seek?" The findings are summarized below:

1. Asked for the main consideration underlying their investment decision to replace, 47 per cent of the companies replied: "possible cost savings if existing machinery, still in reasonable working order, is replaced by new and better machinery"; while 44 per cent referred to the "physical depreciation of existing machinery."

2. About 51 per cent said they make calculations before deciding to replace machinery in all cases; 43 per cent do so only in some cases; and 6 per cent never make such computations.

3. Two-thirds of the respondents used the pay-off period as the only investment criterion; 21 per cent used a flat rate of return; and 3 per cent used the D.C.F. or MAPI techniques.

4. The majority (82 per cent) used a pre-tax basis in their calculations, while the rest (18 per cent) used a post-tax basis.

5. The pay-off periods three, five, and ten years appear to be popular among the respondents. Only 14 per cent indicated a minimum rate of return, and the variation was very wide.

6. A guide explaining alternative methods of investment was recommended by 93 per cent of the responding companies.

A look at these results might give the impression that the techniques used by British industries are crude. But are American enterprises more sophisticated? The use of the pay-off method as the only investment criterion can be compared with the results of interviews undertaken by the reviewer in the Columbus, Ohio area. All twelve American manufacturing companies interviewed indicated use of this method as the major quantitative technique in investment decision making. Other studies have produced similar results.

A. KHEMAKHEM
The Ohio State University

Line of Balance Gives the Answer by NORMAN E. FINCK, *Systems and Procedures Journal,* July-August, 1965.

Use of a 25-year-old charting technique to keep track of progress of non-repetitive production procedures is described in this practical article.

Despite the availability of sophisticated mathematical techniques and high-speed computers, there are times when simpler, older methods will do the job. That is what Douglas Aircraft learned when it looked for a convenient way to record and display progress on all the parts of a relatively complex program, DC-9 aircraft production. Its solution, as Mr. Finck reports in this article, was an adaptation of line of balance, a "simple, 25-year-old, economical, garden-variety charting technique."

The classic line of balance chart consists of a group of charts:

The objective is shown as a graph of the actual cumulative delivery performance plotted alongside the cumulative schedule. The program or production plan is a simple flow chart in milestone form plotted against a lead time relationship to shipping time. Production progress is shown on a simple vertical Gantt chart which quantitatively represents the least available part associated with a given milestone. The line of balance depicts the quantities of cumulative milestone sets that must be available as of the date of the study so that progress on the program can remain in line with the objective.

Charts of this type are used in monitoring subcontractor performance. A modified version, omitting the production plan (since cycle times change so frequently in the early part of the production program) and combining start dates from several different flow charts, is used for Douglas' own internal control.

Douglas, the author says, is happy with the results. The charts provide an instant visual picture of production progress. Trouble spots can be spotted and corrected quickly.

A New Era in Executive Compensation by GEORGE H. FOOTE, *Personnel Journal,* September, 1965; and **The Executive's Compensation and His Career Cycle** by GEORGE H. FOOTE, *Business Horizons,* Spring, 1965.

In these two articles a McKinsey & Company consultant reviews the effects of the 1964 tax law on executive compensation and urges more flexibility in corporate compensation planning to allow for executives' differing needs at different stages of their careers.

The Revenue Act of 1964, Mr. Foote declares in *Personnel Journal,* ushered in "a new era in executive compensation." This new era, he seems to think, is a real improvement over the last one.

Before the new tax law, according to Mr. Foote, the trend was in the direction of "progressively complicating and distorting the executive pay package." These forces were "major villains":

Top management's pay was declining in relation to that of employees down the line.

Deferred compensation was gaining in popularity because of high tax rates on current income.

Stock options were being abused, and inequities in their use were multiplying.

The proliferation of pay elements was weakening the motivational force of compensation.

The 1964 tax law cut tax rates substantially, particularly in the upper income brackets. It tightened the rules governing stock options so that they have, in Mr. Foote's words, lost their tarnish and lost some — but not all — of their luster. And it made company contributions to group life insurance over $50,000 taxable as income to the insured. These changes set off a new set of trends:

Cash compensation is starting to regain a position of popularity it has not held since before World War II.

Companies are subjecting the overall compensation package and all its elements to more intensive review.

Companies are putting more emphasis on ways of relating compensation to performance, to make today's advancing pay scale pay off.

Another way to make more efficient use of compensation dollars, Mr. Foote suggests in the *Business Horizons* article, is to vary pay plans to meet the needs of the various executive groups. Those needs, Mr. Foote emphasizes, reflect the stage of the career cycle each executive is in. A compensation plan that is ideal for a top manager may work real hardship on a young department manager and vice versa.

Mr. Foote identifies three executive career stages. In the early years the executive needs all the current income he can get; he needs dependability of income; and he needs medical, life, and disability insurance. In the middle years he also needs cash income, but he can tolerate fluctuations; he still needs insurance; and he needs to start building a retirement estate. In the later years his most urgent financial needs are to minimize the tax bite on his income and to build up his retirement estate.

Mr. Foote goes on to analyze the principal compensation methods — cash salary, incentive bonuses, deferred compensation, stock options, retirement plans, and various forms of insurance — and to discuss their appropriateness for each group of executives. He ends with a plea for flexibility in compensation planning to give both the company and the executive more for every compensation dollar.

What's New in Sales Forecasting: A Survey of Current Company Practices by ROBERT REICHARD, *Management Review,* September, 1965.

Current practices in sales forecasting are the subject of this survey of more than 300 leading companies and some medium-sized and relatively small ones. The results reveal a wide variety of forecasting techniques and approaches.

The continuing need for more reliable and accurate sales forecasts has sparked improvements in data gathering and forecasting techniques that are supplementing or supplanting yesterday's relatively haphazard, subjective approaches. Mr. Reichard reports that of the companies surveyed, 59 per cent now review their forecasts monthly, 23 per cent quarterly, 13 per cent semiannually, and only 5 per cent on an annual basis. Also, they report closer cooperation and consultation among all the interested departments, even though forecasting is now primarily a staff function in many companies.

A significant finding of the survey is the substantial reliance placed on consultants in determining economic or industry trends.

There has also been a growth in the number of companies using computers for forecasting purposes. It was found that 68 per cent — or nearly seven out of every ten respondents — now have access to computers. According to the survey, an overwhelming majority of the forecasting fraternity has agreed that the results in terms of saving are worth the costs in terms of money and effort.

There is a great variety of forecasting techniques, owing to the differing nature of individual companies. Close to 90 per cent of the companies in the survey are using some combination of the objective and subjective approach to forecasting. However, the general trend is toward greater emphasis on the objective portion of the forecast with the help of electronic computers.

Among the numerous forecasting approaches applied, a few were found to lend themselves to widespread use. Among those cited are the following: (1) the multi-system approach, which includes (a) computerized time series analysis of historical data, (b) an organized weekly method for developing information from sales personnel, (c) general economic information from consultants and professional contacts, (d) periodic interviewing of retailing dealers, and (e) periodic interviewing of major end-use industries; (2) the total system concept, which ties the planning and scheduling of buying, manufacturing, and distribution operations into a total system for each major sales division; (3) the dual-order approach, which distinguishes between "base" orders predicted from past history and "large" orders estimated on the basis of large outstanding quotas multiplied by a "probability" of receipt; and (4) the matrix approach, which involves analysis of the pattern of consumers' re-entry into the market. The author feels that time series analysis and probability theory are essential to sales forecasting; different forecasting techniques can be evaluated by reviewing the accuracy of forecast results.

However, even with a great many sophisticated techniques available, one should still be aware of the difficulties involved in predicting sales which are determined by the intricate mechanism of the market. For example, sales would seem virtually unpredictable if a price war broke out. The most difficult problem probably is the quantification of information; for example, the quantitative interpretation of different actions of competitors, the measurement of the effectiveness of promotional efforts, etc. This is, perhaps, the primary reason why companies still have to rely to a considerable extent on subjective analysis.

The nature of sales forecasting, Mr. Reichard says, may be best described as in this quotation from the manager of International Harvester's sales forecasting department, "Sales forecasting is still largely an art. The statistical tools available to forecasters can and do help elevate this art above that of an exercise in guessing. But these tools cannot elevate forecasting to a science. Consequently, judgment must always be used in evaluating any forecast which is statistically derived."

LUCY LU-CHEN CHAO
University of Illinois

PERT Personnel Practices by LAWRENCE L. STEINMETZ, *Personnel Journal*, September, 1965.

PERT and Critical Path Method scheduling techniques — minus the mathematics — can be used to plan and control any project. This article describes their application to college recruiting activities.

The emphasis on the mathematical calculations and computer programing required for PERT planning of highly detailed and complex defense projects has obscured the advantages of the simpler forms of this technique for everyday management, this author feels.

Actually, he says, critical path networking, minus multiple estimates of completion times and probability calculations, can be used to schedule any project that is sequential in nature. The advantages are complete display of all the events and activities required to complete the job and instantaneous time control through identification of the critical path (the series of activities requiring the longest time to complete).

The author cites the experience of the Sandia Corporation, a defense concern, which used CPM to program and schedule the steps in its college recruiting program. This article describes the method used, reproducing in condensed form the network diagram prepared.

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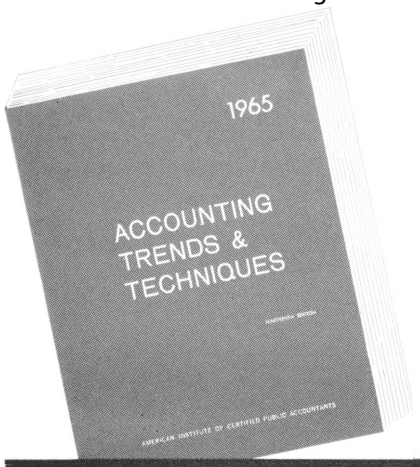
Index to Volume II

Authors and Articles, 1965

Subject Index, 1965

Annual Index



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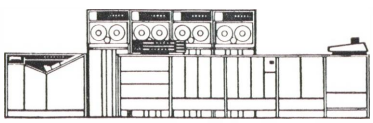
He's the businessman's best friend.



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